THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. APRIL 16, 1896. CHICAGO, ILL. NUMBER 16.

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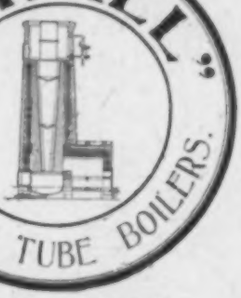

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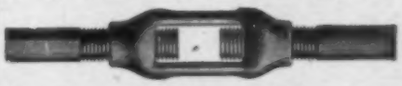

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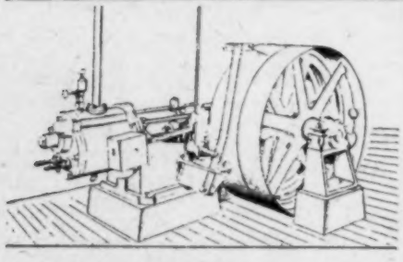

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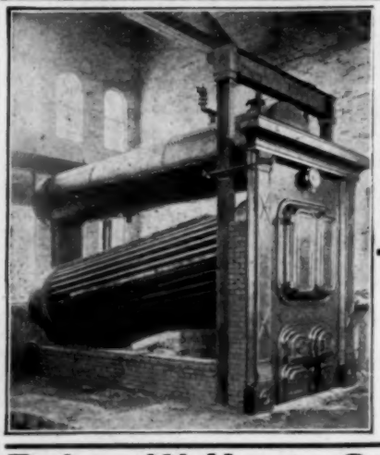

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. APRIL 16, 1896. CHICAGO, ILL. NUMBER 16.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Eastern and Central Western iron markets are quiet and the Chicago district leads in activity for the past week. The higher prices recently announced seem to have acted as a stimulus there; in other sections there is no disposition to hurry matters and large buying covering farther future requirements is wanting. Statistically the pig iron status was not improved in March. Production remained practically unchanged in the month, at a rate close to 10,000,000 tons a year, and a further increase of stocks was the natural consequence. Comparisons with last year in mid-April are commonly made, and they are not particularly encouraging when the present light demand in finished products is set against the quickening of inquiry and of buying that were felt in all lines a year ago. Yet it is to be remembered that consumption to day exceeds that of a like period last year, judged by the pig iron statement, and it is certain that many more men are employed in iron and steel works. Much of the buying of a year ago that made the second quarter a stirring time in the iron market was anticipatory. The bottom had been touched and there was a desire to cover against advances. To-day both producers and consumers are to a large extent taking things as they come. Some heavy pig iron purchases were made, with deliveries to the end of the year, in the recent low dip of prices on Southern iron; but if a gradual rise in prices of finished material should come in the next three months it would not find the mills, as was the case last year, loaded up with uncomfortably low-priced contracts. There has been some reaction in Bessemer pig in the Pittsburg market the past week; and whereas most valley furnaces refuse to go below $13, some sales have been made at $12.60 to $12.85, equivalent to $13.35@$13.60, Pittsburg. Business in steel billets, as in Bessemer pig, has been light. The pool price of $20.25 is in full force, but the few buyers are able to get middlemen's steel at from $19 90 to $20.15. The wire rod manufacturers held a meeting in Cleveland and made progress toward an agreement, but there must be changes in several proposed features before some signatures can be secured and another conference will be held next week. The price established by transactions meantime is about $6 in advance of the billet basis, or $26.75 Cleveland. Two Pittsburg sales are reported at $26.25 and $26.50. The prices lately fixed for sheet bars and tin plate bars have had attention from buyers of these materials, in Pittsburg meetings. A more general affiliation of tin plate manufacturers with the association of that trade may result and prices of their own product, which have been unduly cut by reason of home competition, may be better maintained. The outcome of efforts to get a special concession on tin plate bars, either by conference with the pool management, or by arrangement for outside sources of supply is still entirely problematic. With few exceptions, actual transactions in finished material have not shown the advance in steel, though quotations vary considerably. While 1.45c. Pittsburg is quoted on tank plates, orders have been taken at a lower price, and angles and steel bars have shown weakness. The bar iron men, after a long struggle, have perfected what seems to be a strong arrangement, with a number of familiar pool features, but no change in price was made by the Cleveland meeting. Southern iron is inactive outside of Chicago. The Birmingham basis, under the quadrilateral agreement, is $8.25 for No. 1, $7.75 for No. 1 soft and No. 2 foundry, $7.50 for No. 2 soft, $7.25 for No. 3 foundry, $6.90 for foundry forge and $6.75 for gray forge.

THE CLEVELAND DISTRICT.

Ore buying has started in a way, and the buyers thus far in the market have taken a few hundred thousand tons of Bessemer ores, chiefly from the Gogebic ahd Marquette ranges, on the basis of prices recently announced. Other negotiations are pending. As yet no sales to the chief interests in the Pittsburg and Chicago districts can be announced. The news from the iron ranges gives more promise of freedom from strike troubles —at least for the present. While the eight-hour day is one of the chief aims of the miners' union that has a hold on all Lake Superior ranges, it is intimated that the demand may not be pressed immediately, but will be kept suspended over the heads of the companies. Enough has been gathered, doubtless, from the reductions of force at a number of mines to convince the leaders of the men that increased pay cannot be successfully contended for at this juncture. There is little chartering, in view of the comparative smallness of ore sales thus far; but a number of single trip contracts have been made at 55 cents from Escanaba. Vesselmen hold for $1.10 from the head of the lake for season business and neither side is showing any anxiety. The status of Mesabi ores, so far as preliminary talk among buyers gives indication, will be about that of last year. One leading producer will use 40 per cent Mesabi ores, or a little above the average. However, the probabilities are that quite all the expected production of Mesabi Bessemers will be taken up by the market.

Pig Iron.

There is a lu'l in the pig iron market. Furnace firms in the valleys are doing a good deal of quiet figuring to discover their status under the existing conditions and those that are to prevail in the next few months. The coke problem is no small element in the computation, and while the $2 Connellsville price is a fixture for the present, ways and means of getting cheaper coke are having no little attention, with a view to the immediately future supply; though in some cases plans are under way that look to a greater independence of the

Continued on page 7.

THE CHICAGO DISTRICT.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The market in this district in the past week has been quite active and a number of large sales of various classes of material have been made. The sales of pig iron were a little in excess of those of the week previous. Prices on Southern pig iron have been advanced another 25c. The bar iron market is fairly active and the announcement is made that the Merchant Bar Iron Association is again in control of the situation. In soft steel a considerable tonnage has been closed and prices of rods have been advanced $3 a ton. Structural material has been quiet, no large orders having been placed, but an inquiry has been received from one of the western railroads for a round lot of bridge material which will be placed soon. In plates a good business has been done in small lots and one order for 1,200 tons was taken. Prices generally are firmer than they were a week ago and further advances may possibly be chronicled before the end of the present week.

PIG IRON.—Several of the largest buyers in this market gave contracts last week for their requirements for the season. Notable among these are a large agricultural implement concern and a car wheel manufacturer. The total sales of Southern iron for the week was in the neighborhood of 12,000 tons. The total for Northern iron was considerable in excess of this. Prices of Southern iron have been advanced another 25c a ton by the Alabama producers and the revised quotations are given below. At least one agency, however, is selling iron at the old prices or 25c a ton under our quotations. On the other hand one of the largest Southern producers is quoting iron at 25c above the prices we give. The inquiry for Southern iron appears to have been satisfied to a considerable degree, but Northern furnaces report a very large demand still in hand. Our quotations at present are as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$11 35@11 60
Local Coke Fdy. No. 1	12 50@13 00	South'n Silveries No. 1	11 85@12 35
Local Coke Fdy. No. 2	12 00@12 50	South'n Silveries No. 2	11 60@11 85
Local Coke Fdy. No. 3	11 00@12 00	Jackson Co. Silveries	14 50@16 00
Local Scotch Fdy. No. 1	12 50@13 00	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	12 00@12 50	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3	11 25@12 00	Ohio Strong Softeners	15 00@15 50
South'n Coke No. 1	12 10@12 35	Alabama Car Wheel	16 85@17 35
South'n Coke No. 2	11 60@11 85	Malleable Bessemer	13 50@14 00
South'n Coke No. 3	11 10@11 60	Coke Bessemer	13 50@14 00
Southern No. 1 Soft	11 60@11 85		

BARS.—Mill agents in this territory report that the Cleveland meeting of the Bar Iron Association was successful in gathering into the fold all of the recalcitrant members and that prices are now very firm at 1.30c for common bar iron, Chicago. Close investigation failed to reveal any lower prices than this, and it seems likely that the Cleveland meeting was at least successful in toning up the market. General business in the last week was very fair and there is a considerable demand for round lots of car iron. The B. & O. road has sent out specifications for 5,000 cars, and it is expected that this order will be placed in the near future, divided among some of the Western car works. Quotations are now made as follows: Common iron, 1.30c to 1.35c; guaranteed, 1.35c to 1.40c; soft steel bars from strictly billet stock, 1.30c to 1.40c.

RAILS AND TRACK SUPPLIES.—The local steel company reports a large tonnage closed, almost entirely in small lots. The local mills are now better supplied with orders than at any time before in their history at this season of the year, and the prospects for a continuance of a large trade are very excellent. Quotations are as follows: Rails, $29; splice bars, 1.40c to 1.50c; track bolts with square nuts, 2c to 2.05c; hexagon nuts, 2.17½ to 2.25c; spikes, 1.75c to 1.80c.

BILLETS AND RODS.—A considerable tonnage of both billets and rods was sold in this market last week and the inquiry is still very large. Prices are made at $21.25 for billets and $30.50 for rods.

STRUCTURAL MATERIAL.—No especially large orders have been placed and general business was a little quieter than it was a week ago. The only new business coming up is an inquiry from the Northern Pacific road for 2,000 tons of bridge material. Prices are very firm as follows: Beams and channels, 1.65c to 1.70c; angles, 1.45c to 1.50c; plates, 1.50c to 1.55c; tees, 1.65c to 1.70c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—General business was very good last week and a number of good sized orders were closed, among them being one for 1,200 tons of heavy tank plates. The demand continues good and it is expected that future business will be fully as large as it has been lately. Quotations are unchanged as follows: Tank steel, 1.50c to 1.55c; flange steel, 1.75c to 1.80c; fire-box steel 2.85c to 5c; boiler tubes, 70 to 75 per cent discount.

SHEETS.—There is quite a large demand for both black and galvanized sheets and several round lots of each were sold last week. Quotations are very much firmer and there is considerably better tone to the market. One mill announces its intention of warehousing its product before it will sell for less than 2.35c for No. 27 black or 75 and 10 per cent discount for galvanized. Quotations range from these figures down to 2.25c for No. 27 black to 80 per cent dissount for galvanized.

MERCHANT STEEL.—The demand continues very good and a number of large sales were made last week. Quotations are very firm and are unchanged as follows: open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.65c to 1.70c; smooth finished tire 1.60c to 1.65c; tool steel, 5 50c to 7.50c; specials, 11c and upwards; Bessemer bars, 1.55c to 1.65c.

OLD RAILS AND WHEELS.—Business last week was rather quiet, no sales of any consequence of either wheels or rails being reported. Prices are unchanged. Old wheels are quoted at $13.50 to $14; old iron rails, $14.50 to $15; old steel rails, $11 to $11.50.

SCRAP.—The demand fell off a little last week and sales were hardly as large as those of the week previous. It is expected, however, that the good results of the meeting of the Bar Iron Association will have a stimulating effect upon the scrap market. The following are buying quotations furnished by dealers: Railroad forge, $12 to $12.50; dealer's forge, $11 to $11.50; No. 1 mill, $7.50 to $8; railroad cast, gross ton, $9.50 to $10; machinery cast, $9.50 to $10; axles, $15; cast borings, $4.50; wrought turnings, $6; axle turnings, $7; mixed steel, $8 to $9; stove plates, $7; heavy melting steel, $10.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. There is little change to note in the volume of business, and buyers are showing no disposition to take hold at the higher price recently announced for steel. Bessemer iron has sold below the figures reached in the spurt of 10 days ago. Sales are reported of 3,000 tons, May to July, at $12.90 in the valley, or $13.65 Pittsburg; of 1,500 tons, April and May, at $12.85, valley, and of 3,000 tons, April and May, at $12.65 valley. To-day's quotation is $13.40 to $13.60 Pittsburg. Foundry and forge irons are quiet. The former are quoted $12.60 to $12.85 for No. 1 and $12.25 to $12.50 for No. 2, all ore. Forge is stronger at

$11 to $11.25 for Northern. A sale of 1,000 tons was made at the latter figure. Southern is from 25 to 50 cents above the low prices of two weeks ago. No sales of steel by producers at the $20.25 basis of the pool are reported, but dealers who have billets due on first-quarter purchaser are making prices just enough below the new basis to take the small amount of business that is going. Sales for April delivery are reported at $19.80, $19.90 and $19.95, and a sale for May delivery at $21.15. Muck bars are somewhat firmer, with $21 as the common quotation. Finished material manufacturers generally report that they have not been able to obtain advances, since the publication of pool figures on steel. The Eastern market, theoretically, has a chance now, with only $1.25 advance over the Pittsburg price, while the freight difference is about $2, to hold its trade against Western competition on finished material; but until low-priced ores and low-priced Bessemer pig iron are used up there may be a good deal of unevenness in prices, both between sections and sellers in the same section. Steel bars have not advanced and 1.10c. to 1.15c., half extras, is the quotation, with the lower price more frequently made. Bar iron is stronger since the Cleveland meeting and it seems to be understood that 1.20c Youngstown, for common will be maintained under the pool agreement. In this market some sales were made in the past two months as low as 1.05c for common. Plates are held at 1.45c for tank by some mills, but 1.40c has also been done. We quote shell 1.50c to 1.55c and flange, 1.60 to 1.65c. Structural material is unchanged in price. Building demand continues fair and bridge work is growing in volume. We quote 1.45c for beams and channels; 1.30c for angles, though this price has been cut; 1.35c to 1.40c for universal plates, and 1.45c for tees. In sheets, the inquiry is better, and some mills have advanced prices $2 a ton. We quote No. 27 at 2.25c to 2.30c; galvanized sheets at 75, 10 and 5 per cent discount. Pipe and tube mills are maintaining firmly the discounts announced three weeks ago and report demand somewhat enlarged.

Cincinnati. It was the opinion of many that the extraordinary buying of March, which was a large increase over January and February, would result in a lull in early April, but this has not been realized, as the business of the first week of April kept pace with the activity of the past month, though the orders for immediate delivery have not been sufficiently large to take up the current output and the winter accumulation. The indications are that the general manufacturing and mercantile business of the country is not participating in the buoyant traffic in iron and steel, and consumers of the metals find no response in the trade warranting the advances in prices for raw iron and steel; on the contrary, many complain of continued dullness and are pessimistic as to the outlook. Throughout the trade there has been a feeling of opposition to the combinations among the steel makers and pig iron manufacturers through the fear that extortionate and unreasonable prices would be exacted, but a fuller understanding of conditions dissipates these apprehensions. There is a way to reduce the cost of iron and steel, and that is by cutting the wages of the miners of the ores and coal back to the scales of late 1894 and early 1895, which would mean strikes, lockouts and expensive trouble, but the companies and corporations know full well that would also mean deprivation and almost starvation to the miners and laborers, which condition they seek to avoid. The railroads refuse to reduce the freight rates to the low level of last spring, and their refusal has the approval in the main of fair minded shippers, as the prosperity of the railroads adds in many ways to the prosperity of the manufacturers and merchants the country over. The buying ability of the mechanics, miners and laborers of the United States determines the condition of general business. These reflections and considerations actuated the masters and proprietors of the metal interests to seek co-operation in maintaining the current wage scales, and arranging selling prices that would enable them to secure a reasonable return for their investments and endeavors, and consumers appreciating the facts are acquiescing in the plans and organizations inaugurated. The market closes irregular in spite of the schemes to sustain remunerative prices. The strong companies with order books well filled are firm, the leading Southern iron company has the largest number of orders and the largest tonnage on its order books in its history.

Buffalo. The conditions of the local market are not as favorable as the reports received from other fields. Demand has been light and there has been a disposition on the part of both sellers and buyers to defer consideration of anything which looks beyond the present time. This is in contrast with the activity west and south of here, where a large tonnage has been sold to buyers who anticipated higher prices in the near future. We quote as follows: No. 1 strong foundry coke iron, Lake Superior ore, $13@$13 25; No. 2, $12.50@$12 75; No. 1 Ohio strong softener, $13@$13.25; No. 2, $12 50@$12.75; Jackson county silvery No. 1, $14 75@$15.25; Southern soft No. 1, $11.75@$12; Southern soft No. 2, $11.50; Lake Superior charcoal, $13 50@$14.

St. Louis. The heavy sales of Southern iron have stiffened up prices and the market is stronger to-day than for several months past. Buyers seem to be of the opinion that there will not be such a tremendous advance in iron as last year, but predict a steady market at prices somewhat higher than are ruling to-day.

A RAILROAD extension soon to be built in Western Pennsylvania is of importance in that it guarantees to the Carnegie Steel Co. a lower freight on ore than it has had heretofore. A charter has been granted at Harrisburg to the Butler & Pittsburg Railroad Co., with an authorized capital of $5,000,000. The new line is to be 42 miles long and will connect the Pittsburg, Shenango & Lake Erie Railroad at Butler with the Union Railroad, owned by the Carnegie Steel Co., Ltd, which will thus find a more direct and quicker route for ore and coal shipments. It is expected that the line will be in operation within a year. The Pittsburg, Shenango & Lake Erie and the new line will ultimately be consolidated, it is said. The contract recently made with the Carnegie Steel Co., the Union Railroad Co. and the New York & Cleveland Gas Coal Co. guarantees the railroads, whose lake terminus is Conneaut, additional freight of 2,100,000 tons yearly, as a minimum for 25 years.

THE bid of the Consolidated Steel & Wire Co. for the plant of the Enterprise Co., of Joliet, Ill., which was opened April 8, was accepted by the circuit court on April 11. The sale of this plant was very opportune for the Consolidated Steel & Wire Co., as the company's wire drawing and wire nail departments at the Joliet mills were destroyed by fire recently, and left the plant with no finishing department. It is expected that the Enterprise plant will be put in operation by the Consolidated company as soon as it can be made ready, which will be in a short time.

The Chicago Pneumatic Tool Co., 1518 Monadnock Block, Chicago, has received orders from London for 73 boiler riveting hammers since Dec. 15.

THE IRON TRADE REVIEW

DEVOTED TO

IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

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APRIL 16, 1896.

A STRONGER BAR IRON ORGANIZATION.

The Merchant Bar Iron Association at its meeting in Cleveland last week put a period to the uncertainty about its existence that has stretched through the past two or three months. After a season of suspended animation, so near akin to death that even memorial words were written, there is to-day a proof of new life that cannot be gainsaid.

Whether the success of the steel manufacturers in forming the billet pool had its influence cannot be said. Certainly it did not retard the similar effort in the bar iron trade. At all events the bar iron pool is a fact. Good round checks were given by the membership as an earnest of their intentions, before the Cleveland meeting dissolved, and 1.20c Cleveland and Youngstown, and 1.30c Chicago, East St. Louis, Cincinnati and Louisville, are now well established, with indications that they will be firmly maintained.

While 86 per cent of the bar iron tonnage west of the Alleghenies seemed to be the limit of possible signatures before the Cleveland conference it is now understood that something over 92 per cent is represented in the new pool, and that there are some producers outside, who, while not in position to agree to a restriction of their output, are willing to maintain the price fixed by the pool.

The scheme of organization is similar to that of other pools. The basing percentage to which each mill in the association is entitled is determined by the record of output for four months and in part by the character and equipment of the mill. Reports of shipment of material are made each month to the commisioner of the pool, and a $2 per ton tax is imposed for shipments over the monthly tonnage assignment, while a $2 allowance is made to mills whose shipments are under their percentage. The money deposit feature and the fines for non-compliance with the agreement are a strongly constructed feature of the document. With $1 a ton on its monthly output deposited with the commisioner, and this amount subject to forfeit in case of withdrawal or expulsion before the year fixed as the life of the agreement, and a fine of $500 for each violation of the articles, it would appear that no mill would lightly yield to the temptation to undersell. Sales through brokers, unless authorized agents of mills, and registered as such, are prohibited and no mill may pay any commission which is to be divided with the buyer.

Other features of the new organization are designed, like those above enumerated, to prevent over-production and the demoralization which so notoriously characterized the bar iron market before the Merchant Bar Iron Association came into existence a year ago. Whatever mistakes may have been made under the plan of organization that has been operative heretofore, they seem to be effectually guarded against in the scheme just perfected, and greater stability and uniformity seem now to be assured.

WAGES AND PRICES IN IRON AND STEEL.

It is not hard to believe that many of the decisions arrived at in labor councils are the direct result of sophistical arguments or distortions of facts about wages and markets, by imported agitators. The statements of these men are taken at par, because they go up and down the country and are supposed to be in position to know things that the local wage-earner, shut up to his daily round, could not find out for himself. That the words of the traveling agitator are accepted as gospel is shown by an incident reported by the Marquette *Mining Journal* in connection with one of the recent meetings of Lake Superior iron miners. The imported stirrer up of strife, who addressed the men, made his point after this fashion:

"The employers are organized, and why should not the workingmen? You may have read that a big steel pool has just been formed, and that it has already advanced the price of steel billets $3 per ton. Following this, pig iron has gone up $1.25 a ton. *How much of that will you get?* You are entitled to some of it. See that you get it!"

Needless to say, this style of oratory was received with stormy applause and nods of approval. In his blundering ignorance or his professional craftiness, the speaker gave his hearers to understand that the producers of pig iron and of billets had been making a fair profit on the old market price and had just secured an additional advance, of which labor was entitled to a share. He did not know, or he suppressed the fact, that labor, in pig iron and billet production, has been paid for months on the basis of the boom prices of last summer, whereas the market has fallen away between $5 and $6 a ton on both Bessemer iron and steel billets, from the height of the boom. Labor at Mahoning and Shenango valley furnaces got advance after advance last year, up to 40 per cent above the old wages, and though Bessemer pig iron declined steadily in the latter part of 1895 and the early part of 1896, many sales being made at figures either below or barely covering cost, wages remained the same. And when $1.25, or about one-fourth of the decline, had been recovered, the Michigan agitator vehemently appeals to his hearers to see that they get the share of the advance to which they are "entitled!"

And similarly with billets. The object of the billet pool is to establish the price at a figure proportioned to the new cost of Bessemer pig iron, with standard Gogebic Bessemer ores at $4. Steel makers had simply the alternative of getting the price up or of getting their labor cost down. The two had been clearly out of proportion for more than six months. Yet with the new pool rate fixed at more than $3 short of the top price of last year, labor is exhorted to see that it gets its "share!"

Manufacturers, the traveling agitator to the contrary notwithstanding, do not want low wages. When the purchasing power of wage earners is low, all industry

feels the lack. Manufacturers are most prosperous when labor is able to buy freely. To make wage reductions is like flying a signal of distress; and no manufacturer hoists the signal without exhausting every other resource.

That iron and steel capital has patiently endured the unequal situation of the past six months, leaving wages for the most part untouched, after the successive advances of last year, is greatly to its credit. Under such circumstances the words of the Lake Superior orator, and similar ill-timed claims by labor organizations, are not conducive to a pacific mood on the part of capital. However, so far as their own industry is concerned, we take it that there are intelligent miners enough on Lake Superior to read the plain signs of the past few weeks. If the miners' union would draw a conclusion from the billet pool, let them consider that one of the prime objects of such an organization is a limitation of production to actual consuming capacity. And if billet production is curtailed, that means a corresponding limitation upon the production of Bessemer ores.

So far as last year is concerned, what with high freights and the small proportion of the year's product that brought prices above those of the opening, the Lake Superior mining companies did not find it a year of profit. Yet wages were raised before the season closed, and later, in advance of any sale for 1896, a further increase was made at a number of properties in expectation of a higher price for the ore this year. The curtailment of tonnage due to the changed conditions in the iron market, will mean a considerable reduction in the anticipated profits of this season. One year of profit in four is not what the average capitalist would consider a satisfactory investment; yet Lake Superior mining companies will have completed just such a cycle with the end of the present year. It does not seem that the miners are taking wise counsel in making preparations for intermittent labor and expensive tests of strength, in the light of the history of the business since 1892, and the conditions that surround it at the present time.

IRON AND STEEL IMPORTS.

From the Treasury Department statistics, we compile the following statement of imports of iron and steel into the United States in February and the eight months ending Feb. 29, as compared with like periods in the preceding year:

IRON AND STEEL IMPORTS TO U. S., IN FEBRUARY 1895-96, AND IN EIGHT MONTHS ENDING FEB., 1895-96.—GROSS TONS.

	February.		Eight months ending Feb.	
	1895.	1896.	1895.	1896
Pig iron	1,174	8,849	9,798	61,418
Scrap iron and steel	178	228	1,801	6,622
Bar iron	295	355	9,967	17,596
Rails	.....	1	312	970
Hoops and bands	.....	.....	173	15
Ingots blooms etc	1,050	1,242	8,418	22,865
Sheets and plates	1,462	554	21,678	7,603
Cotton ties	.....	.....	5	3,485
Tin plates	15,044	10,700	148,963	132,620
Wire rods	2,120	1,525	16,386	19,960
Wire, etc.	276	208	3,213	3,287
	21,599	23,665	220,814	276,443

The dwindling tin plate and black plate imports are again reflected in the figures. The gain in iron ore is another feature of the import statement. In February 77,389 tons were brought into the United States, against only 21,603 tons in February, 1895. For the eight months ending with February the total was 535,194 tons against 145,782 tons in the eight months ending Feb. 28, 1895.

THE Lehigh Valley Railroad has made a contract for 1,000 coal cars with the Michigan-Peninsular Car Co.

THE CLEVELAND DISTRICT.—Continued from page 3.

Connellsville field. The $13 figure for Bessemer is still maintained by the majority of valley furnaces, though $12.75 and $12.65 have been done. There is very little doing. The fact that steel makers do not sell to brokers, may lead to more restricted buying from that interest, also, and sales of Bessemer pig iron may come to be made direct, to a greater extent. That is one hopeful consideration, from the standpoint of merchant furnaces. It is stated, also, that with anything like an average demand for finished products it is not unlikely that the leading Pittsburg producer will still be a buyer of iron, even with its new furnaces in operation. Yet the restriction of the billet output promises to compel some reduction of Bessemer pig iron production in the near future if prices of the latter are to be held with any firmness. Foundry iron has had a slow sale in the week. For No. 2 valley iron, $12.25 to $12.75 Cleveland, is the range of quotations and $13 to $13.25 for No. 1. Scotch irons are quoted $12.75 and $13.25 Cleveland, respectively, for No. 2 and No. 1. Cleveland foundries make various reports as to their melt of iron as compared with last year at this time. Few are doing more than in April, '95, some note no change; the majority are doing less. The daily consumption of iron may be put down as less than at the same time in 1895. In forge little is doing. Valley furnaces quote $11 at furnace. Southern forge can be delivered in the valley under the new basis at about $10.65. Lake Superior charcoal is maintained at $13.50 Cleveland, with light buying as yet.

Billets and Rods. No Cleveland transactions have been made on the pool basis of $20.75 for billets, though a sale is reported through a Pittsburg dealer at $20.50 delivered in Cleveland. The report is current that one Central Western steel plant will be shut down by the pool, though this cannot be verified. It is more likely such a plan would be adopted to prevent overproduction, than the partial or spasmodic operation of all plants. The wire rod men, in a two days' conference in Cleveland, failed to make the arrangement proposed, some concerns being unwilling to accept the proposed limitations on output. Further effort will be made, however. We quote $27 Cleveland.

Finished Material. Demand is made up of small orders and there is no disposition in this market to launch out on extended contracts. Bridge building and architectural work are furnishing a fair tonnage to the mills. The Northern Ohio bridge works have taken several contracts of moderate size lately and other larger work is being figured on. The W. & L. E. bridges, involving several hundred tons of plates, angles, etc., have been placed and one or two local building contracts have been taken. The material for the new street car house went to Pittsburg. In connection with one local contract a low price is reported on angles, 1.25c Pittsburg, being cut. Plates are held at 1.54c Cleveland, for tank, though some mills have gone $1 lower. Steel bars are quoted 1.10c to 1.15c Pittsburg, or 1.19c@1.24c, Cleveland, half iron extras; but a flat price shading 1.25c Cleveland quite a little has been made on some recent business. The bar iron agreement is now a very tight one, as detailed elsewhere, and 1.20c in car loads and 1.25c less than carloads, Cleveland and Youngstown, are strictly maintained. Central Western railroads continue to buy in a small way. In addition to the C. L. & W. and the W. & L. E. orders for 1,000 tons of rails each, as recently reported, the Ann Arbor road has been in the market for 1,000 tons.

DEVELOPMENT OF THE MILLING MACHINE.

At a recent meeting of the Manchester, Eng., Association of Engineers, Mr. Samuel Dixon read a paper on "The Development of the Milling Machine for Heavy Engineering Work," in which he reviewed the progress in milling that had been made in large engineering works. He referred in the beginning to the cardinal principle of milling, viz., the employment of a small series of cutting edges, prepared so as to relieve each other in rapid succession, and to avoid the fatigue of any single one as compared with the employment of a single cutting edge, which would have to bear the whole brunt of the work without any relief. It is upon this idea of the employment of a battalion of cutting edges in the machining of any surface, to the best advantage, that the whole element of design in milling machines has turned of recent years, and so rapid has been the development, that whereas machines of two or three tons weight were a few years ago considered heavy milling machines, to-day machines of 15, 20, and even 30 tons weight are becoming common.

Perhaps one of the great elements in the problem least easily grasped by machine tool makers has been the fact that the conditions under which a series of cutting edges can be got to work are very widely different from those of a single point, and this, perhaps, accounts for some of the very lame designs of milling machines in the market. The strains upon a single-pointed cutting tool are very simple, and can be easily grasped, so that if provision is made for firmly clamping and supporting the same, little apprehension need be felt as to its doing its work satisfactory. In milling machines, however, the necessity for a free rotary motion of the tools, and at the same time the most unyielding support of same, presents a problem very different from that of a single tool. For instance, how many designs of milling machines of the planing machine type had been made which seemed to assume that it was only necessary to support the tool longitudinally by uprights of the same form as in planing machines, whereas the transverse strains showed how fallacious was such an assumption. One great hindrance to the development of milling has been the existence of surfaces which were originally designed for machining by a single tool, and on which a series of cutting edges can not be employed, and a very important point in its development has been the design in recent years of machines specially arranged for getting this battalion of cutting edges to work on practically any surface that can be presented. With reference to the design of surfaces for milling, much can be done when it is fully understood that such surfaces have to be milled. There has often been a difficulty for planing machines to machine surfaces designed by some freak, which rendered it almost impossible, and milling machines are now passing through much the same development. This question of care in the design of surfaces is most important, and it is surprising how frequently engineers neglect it.

In reviewing the development of this work of machining surfaces by rotary cutters, the speaker emphasized the rapid development of the process to meet the wants of general engineers, where it was necessary to have machines capable of machining practically any surface on heavy engineering parts, large or small. All surfaces on engineering objects may be considered as having been formerly finished on shaping machines, slotting machines, planing machines, with the object reciprocating, or on large objects which are fixed and the tool traversed as in side-planing machines, wall-planing machines, etc., and Mr. Dixon gave numerous illustrations with detailed descriptions of the modern types of milling machines which had been designed to take the place of the above tools in engineering work. Surfaces formerly finished on shaping machines are now almost invariably finished on horizontal milling machines, with the ordinary spiral cutlery, where simple flat surfaces are concerned, or with gang cutters where several surfaces can be finished at one cut, as in the caps of pedestals or other similar objects. In such work there is an enormous saving, as a plain surface is finished quicker by milling than by shaping, and where several surfaces have to come together, or are required to be uniform in thickness or width, this uniformity can be ensured with the greatest certainty, whereas in shaping there is such a number of small errors and variations among the objects machined, that the liberal use of the file, and consequent expense is unavoidable. Take such objects as sewing machine dies, which are required to be uniform in thickness and breadth. By the older process of shaping or planing, the cost of machining alone is quite double or treble that of milling, and even after machining, slight deviations are always to be found among the dies shaped, which have to be rectified by filing. By milling, however, these can be produced perfectly uniform in thickness and breadth. Again, there can be no question that the finish of a surface from milling is far superior, in most objects, than that produced by shaping, and is in fact superior to what can be produced by the machine and file together.

In addition to these plain surfaces which can be best milled with the plain spiral cutter, there is a larger class which can be done by face cutters, which for comparatively small objects are made solid, but which when made with inserted teeth can be of practically any size. This form of cutter lends itself admirably to almost every class of work, and is doing a great deal for the development of milling. One advantage of the cutter with inserted teeth is its comparative cheapness. The weight of steel used in any one cutter is so small and of such simple section that any ordinary workmen can make, harden and insert them, and a steel of the very highest quality can be employed, giving the same advantages in milling as are derived from the use of such steel in tool-holders for turning, planing, slotting, etc. The erroneous idea, occasionally found among engineers, that milling is not suitable for general miscellaneous surfaces, but only where a number of small objects had to be made exactly alike, no doubt arises from a recollection of the field in which it first made its mark, namely, amongst small objects for sewing machines, knitting machines, small arms, etc., for which the machines are very special, and of extremely limited capacity, so that an object with a slight variation in form can not be dealt with upon them. To-day, however, this state of things has altered entirely, and while there must ever remain a large number of special machines only suitable for particular work, there are also machines of a perfectly universal character, ready for machining any surface upon which a little common sense has been expended in the design, and the common spiral cutter and the face milling cutter with either solid or inserted teeth, are together capable of machining almost any surface whatever. All that is required is a machine constructed to quickly present one or other of these cutters to the surface being machined, and at the same time, have the cutters supported in such a manner as to get the maximum amount of work from them.

Circular milling machines, Mr. Dixon pointed out, are the type for use where all such objects as cranks, levers, etc., with circular ends, have to be machined, but there is a wide field open for completely milling circular objects more economically than by turning, even carrying the idea as far as milling the edges and faces of pulleys and similar objects at the same time.

The profile milling machine lends itself well to milling objects of irregular form, such as cams, levers, etc., and for this purpose the table is left free to slide longitudinally, so that a template of the same shape placed under the work determines the advance or withdrawal of the work as it passes before the cutter during the action of the transverse feed. It is of great importance when taking heavy cuts to have a bearing for the lower end of the mandril, though it is surprising how much can be done without any support. For general engineers, the question of profile milling is only of secondary interest. This type of machine, which he was tempted to call he slotto-milling machine, is also capable of doing an immense amount of work with face milling, quite apart from its general work as an edge miller, so that by using face as well as spiral cutters objects can be milled on top and on all four sides at one setting.

A very interesting group of machines is those for doing work formerly done on planing machines, which from their similarity of outline and functions are known as plano-milling machines. He had often thought that the design of the common planing machine has been on wrong lines from the very beginning, for to reciprocate a heavy table of 10 to 15 tons weight, or a total load of 20 to 30 tons at speeds varying from 20 ft. to 50 ft. per minute, absorbs an enormous amount of

power; but in milling machines this rapid reciprocation of heavy machines is entirely dispensed with. It is well known that quite a third of a man's time, and also that of the producing capacity of many valuable machines, is lost in the setting of work. This is unavoidable in planing machines, as nothing can be set on the table while in motion, but in milling machines the movement of the table is so slow that, by having the machine sufficiently long, a second object can often be set ready while the other is being machined, and the man and the machine can be continually employed, so that a saving of one-third in the producing capacity of the machine can be effected from this circumstance alone.

In conclusion, the speaker expressed the opinion that almost all surfaces can be brought within the range of the milling machine, especially if in designing the few simple requirements of milling are kept in mind. He would not imply that planing machines would be put out of use in engineering works; but the great advantages of milling suggest that in designing their work for economical production engineers assign a much larger share to milling machines. It should be noted, however, that accuracy is necessary with this group of machine tools above all others, as well as thoroughness in the design of all details.

CONDITION OF BLAST FURNACES OF U. S.*

April 1, 1896.

Location of Furnaces.	Charcoal.					Bituminous or Coke.				
		In Blast.		Out of Blast.			In Blast.		Out of Blast.	
	Total No. of Stacks.	Number.	Weekly capacity.	Number.	Weekly capacity.	Total No. of Stacks.	Number.	Weekly capacity.	Number.	Weekly capacity.
New England	11	1	143	10	946	.....	.....	.....	.....	.....
New York	6	.....	.....	6	731	5	2	3034	3	3335
Pennsylvania	13	1	60	12	924	5	2	2248	3	2390
Pittsburgh	.....	.....	.....	.....	.....	25	23	44675	2	3077
Spiegel	.....	.....	.....	.....	.....	1	1	1032	.....	.....
Shenango Valley	.....	.....	.....	.....	.....	16	11	14827	5	4932
Jun. and Con. Vals.	.....	.....	.....	.....	.....	17	8	9538	9	4749
Maryland	4	.....	.....	4	327	5	1	1959	4	4675
Virginia	4	.....	.....	4	210	23	13	8731	10	6031
North Carolina	.....	.....	.....	.....	.....	2	1	104	1	650
West Virginia	.....	.....	.....	.....	.....	4	2	2624	2	1434
Ohio—Mahoning Val.	.....	.....	.....	.....	.....	12	10	13188	2	3090
East, Cent. & North.	.....	.....	.....	.....	.....	17	11	14756	6	8520
Hocking Valley	.....	.....	.....	.....	.....	6	.....	.....	6	2606
Hanging Rock	10	2	230	8	645	11	8	2724	3	605
Kentucky	3	.....	.....	3	865	6	3	1891	3	1280
Tennessee	8	2	745	6	1600	13	5	4553	8	5474
Georgia	3	1	282	2	375	2	.....	.....	2	1300
Alabama	10	2	722	8	1762	39	18	19384	21	12595
Indiana	.....	.....	.....	.....	.....	2	.....	.....	2	275
Illinois	.....	.....	.....	.....	.....	19	14	27136	5	6053
Michigan	20	5	2071	15	4767	.....	.....	.....	.....	.....
Wisconsin	3	1	870	2	470	4	3	3301	1	826
Minnesota	.....	.....	.....	.....	.....	1	.....	.....	1	665
Missouri	1	.....	.....	1	275	2	.....	.....	2	1710
Texas	4	.....	.....	4	935	.....	.....	.....	.....	.....
Oregon	1	.....	.....	1	280	.....	.....	.....	.....	.....
Colorado	.....	.....	.....	.....	.....	3	1	1437	2	1600
Total (char. and coke)	101	15	5123	86	15162	240	137	177142	103	77992
Total anthracite (New York, New Jersey, and Lehigh, Schuylkill, Upper and Lower Susquehanna and Lebanon valleys.)	126	44	29409	82	38083	.....	.....	.....	.....	.....

SUMMARY.

Fuel.	In Blast. Number.			In Blast. Weekly Capacity.			Out of Blast. Number.		Out of Blast. Weekly Capacity.	
		Month Previous.	Year Previous.		Month Previous.	Year Previous.		Month Previous.		Month Previous.
Charcoal	15	17	17	5,123	5,259	3,679	86	85	15,162	15,309
Anthracite	44	51	33	29,409	34,591	19,952	82	75	38,083	32,670
Bituminous	137	138	119	177,142	172,895	130,870	103	102	77,902	80,493
Total	196	206	169	211,674	212,745	154,501	271	262	131,147	128,472

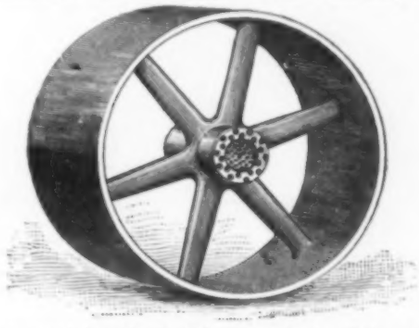
*The above table is condensed from the *American Manufacturer*. The tables of the *Iron Age* show in blast April 1, 20 charcoal furnaces, with 5,289 tons weekly capacity, instead of 5,123; 183 coke and anthracite, with 183,692 tons weekly capacity, instead of 181 (adding together "bituminous" and anthracite in above), with 206,551 tons weekly capacity. Total 203 active furnaces, with a total capacity of 190,281 tons, instead of 211,674, as above.

THE Colorado Fuel & Iron Co. has sold 12,500 tons of rails to the Union Pacific for early delivery.

OILLESS BEARINGS.

The North American Metaline Co., 40-48 Third st., Long Island City, N. Y., is the sole manufacturer of what it designates as "oilless bearings," the use of which for bushings dispenses with oil or other lubricant for loose pulleys. The material of which these bearings are made is a gun or composition metal bushing, in halves, with the bearing surface drilled and filled with plugs of Metaline—a patented composition metal, for which the chief claims are self-lubrication and great durability. A set of bushes made of Metaline and used in a prominent shop in Newark, N. J., were recently replaced after eight years of service on a loose pulley running 380 revolutions a minute, no oil or other lubricant having been used during that time. Aside from the saving of time and money and the immunity from care of pulleys on which metalined or oilless bushes are used, the relief from anxiety in connection with fire risk is a consideration of some importance. No oil being used, the bushes are clean and can be run in places where the use of pulleys would otherwise be prohibited on account of oil splashings. The following is presented by the manufacturers as a typical testimony. It is from F. W. Taylor, foreman of the machine shop of the G. & T. Fairbanks Co. scale manufactory, at St. Johnsbury, Vt.:

"About a year ago I became interested in your metalined bushings through an advertisement I saw somewhere and sent to you for your circular. I had not much faith that your bushings would do what you claimed for them, however. We had two loose pulleys on an elevator shaft that had given us a good deal of trouble, and at my recommendation a set of your metalined bushings were ordered for them. The shaft is 2 7-16" diameter and runs 200 revolutions per minute. The pulleys are 24" diameter, with 12" face, and run constantly 10 hours a



day. Upon receiving the bushings we took off the pulleys and bored them out large enough to take in the bushings and put the shaft back again. We started the newly bushed pulleys April 28, 1894, and they have run constantly up to this time without a particle of lubricant of any kind. After running the elevator shaft about a month, and satisfying ourselves that the pulley would not heat, we ordered another set of bushings, for a loose pulley on a dynamo counter-shaft that had given us a great deal of trouble. This loose pulley is 24" diameter and takes a 12" double-thick belt, which we have to run very tight. The pulley runs 420 revolutions per minute. We always had a great deal of trouble with this pulley. Some days we would have to keep a man over it nearly all the time to keep it running, and at one time it got so bad that we had to replace both counter-shaft and pulley with new ones. June 9, 1894, we started it up with metalined bushings, and we have never had one minute's trouble with it since."

Good Specimen of Cast Iron.

In removing a cast iron bushing of a locomotive cylinder recently at the Baldwin Locomotive Works, the excellent quality of the iron was strikingly illustrated. The cylinders were originally about 20 in. in diameter, and for some reason been bushed to 19 in. by the builders. It was decided to remove the bushing, and it was cut out with a boring bar until a thin shell was left in which the metal was $\frac{1}{32}$ to $\frac{1}{16}$ in. thick, forming a complete cylinder. When the shell was cut open the metal spread out flat like a piece of sheet iron.—[Railway Gazetee.

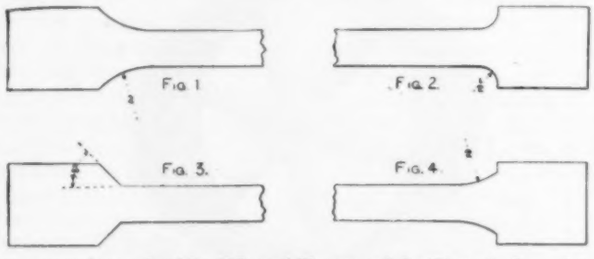
THE name of the Union Foundry Co. at Grand Rapids, Mich., has been changed to the Grand Rapids Foundry Co., and the capital stock has been increased to $25,000.

FORM OF TEST PIECES FOR STEEL PLATES.

The current issue of the *Digest of Physical Tests* takes issue with the committee of steel manufacturers that recommended to the Board of Supervising Inspectors of Steam Vessels, at Washington, the form of test specimen for boiler steel recently adopted by the board. As the committee had on it a number of engineers, and as all its members directly represented the manufacturers in whose interest the *Digest of Physical Tests* makes its protest, it would seem that "all practical steel plate and rolling mill owners" are not entirely in line with the criticism, which we reproduce below:

"All practical steel plate and rolling-mill owners will join us in entering our protest against the adoption of a standard test specimen of the form recommended in the amendments recently submitted by the committee of the American Steel Manufacturers to the Board of Supervising Inspectors of Steam Vessels at Washington. The specifications provide that the test-pieces shall be prepared in the form shown in Fig. 1, which, every practicle engineer will see at a glance, is a very difficult and expensive shape to make. When it is considered that some of the large mills pull their tests at the rate of 60 per hour on a single testing machine, it will be appreciated that the cost of preparing the specimens is a very important item in the expense of maintaing a laboratory. Sixty specimens per hour is, we think, far too fast to obtain reliable results, giving too high a tensile strength and destroying the elongation, but to be able to pull even half this number per hour, requires the use of the most modern appliances for preparing the specimens.

"Before the introduction of special tools for this purpose, it was not unusual to see as many as six shapers running to supply one testing-machine. Test pieces prepared on a shaper have both edges parallel throughout their length, but these in



turn, as shown by Mr. Edward Haupt, of the Phœnix Iron Co., have too great an elongation. In later practice various other more rapid methods have been tried, among which are the Newton saw and the Ingersoll planer. The saw was never destined to set rivers on fire, and soon dropped into oblivion, while the Ingersoll planer, though a large and powerful milling machine, well adapted to a wide range of usefulness and capable of rapid work, possesses the disadvantage of only milling one side of a row of specimens at a time. The newer machines are designed on the rotary planer principle, and finish both sides of a row of test pieces simultaneously. The machines are fitted with two heads, each carrying from 8 to 12 tools. The shape of these tools fixes, of course, the shape and size of the fillet in the test specimens, and since the tools, to obtain a smooth finish in the test pieces, must be dead in line, it is necessary to grind them after they are set in the heads. By using tools ground to form a specimen the shape of Fig. 2, this grinding is reduced to a comparatively simple operation. They can, however, be more readily ground to give the form shown in Figs. 3 and 4, but to produce the test piece shown in Fig. 1 requires the use of an axle-mill four inches in diameter, and the slow process of feeding the cutter by hand until it reaches the required depth, this tedious task only being obviated by the additional expense of a special grinding machine to round the corners of the cutter, so as to permit cross-milling.

"Why, in these times of systematic inspection of material by 'high-class experts,' manufacturers should be obliged to incur the heavy expense of preparing test specimens in the form proposed by the committee, when other and cheaper forms give precisely the same results, and curtail the tax on the time and patience of the Government inspectors who are obliged to remain idle while the test pieces are being prepared, is, to us, an unexplainable mystery."

LAKE SUPERIOR IRON MINES.

At the Chandler mine 700 men are now employed and over 2,000 tons a day is being raised. The stockpiles now contain 280,000 to 290,000 tons of ore. The Pioneer, which adjoins the Chandler, has upwards of 70,000 tons of ore in stock. The new hoisting plant is about in readiness. A new body of ore has been struck recently at the Zenith.

Mining operations have begun at the North Cincinnati mine at Biwabik, Minn. The ore is sold by Corrigan, McKinney & Co., of Cleveland.

The Canton mine on the Mesabi is likely to shut down about May 1. Its stockpiles will contain by that date nearly all the ore that the mine is expected to market this year.

The 1896 production of the Lake Superior Consolidated Iron Mines, from the Adams, Mountain Iron, Minnewas and the Lake Superior group has been put at 782,000 tons.

An iron and timber land deal is pending with the Nelson Lumber Co. The Weyerhausen syndicate proposes to take the lumber company's lands and plant, its logging railroad and its interest in the Falls Boom company at a figure approximating $2,000,000. The iron lands are being figured on by the Minnesota Iron Co. They include the Auburn mine, which the Minnesota Iron Co. now has under lease at 25 cents a ton royalty. Other portions of these lands are also held by the Minnesota Co. under lease. The purchase price now talked of is $1,200,000

Negotiations are said to have been completed between the heirs of R. W. Nelson and Chas. H. Foote, representing Chicago interests, for lands in the Crystal Falls district, including the Youngstown mine. It is expected that the mine will be operated, though no definite announcement is made as yet.

Work has begun at the Biwabik mine. A production of 350,000 tons, which includes some ore sold last year but not shipped, is expected for 1896.

The new ore dock recently completed at Escanaba has 226 pockets and a capacity of 30,000 tons. The five docks at Escanaba can now accommodate 160,000 tons of ore. The mines have begun forwarding ore to Escanaba and about 4,000 tons have been received thus far.

The delegate convention of the Lake Superior iron miners' union, in session at Ishpeming, Mich., this week decided in favor of demanding an eight-hour work day. The matter was put in the hands of the executive council of the union, however, and it is understood that it will not be pressed upon the mining companies under present conditions. The fact that the expected output of ore has been cut down and the action of several of the mining companies in reducing their working forces are taken as indications that a strike now would not be successful. The presentation of the demand may be delayed for several months.

Personal.

F. N. Hoffstot, treasurer of the Clinton Iron & Steel Co., Pittsburg, has gone to Europe on a health trip.

H. E. Collins, of the well-known firm of H. E. Collins & Co., Pittsburg, who has been in ill health for nearly a year, is now fairly on the road to recovery.

L. W. Young has resigned his position in the Pittsburg sales department of the Carnegie Steel Co., Ltd., and has connected himself with the Pittsburg selling firm of Joshua Rhodes & Co.

F. H. Treat, the new superintendent of the Cleveland Rolling Mill Co.'s works, his service beginning with the present year, was formerly superintendent of the North Works of the Illinois Steel Co.

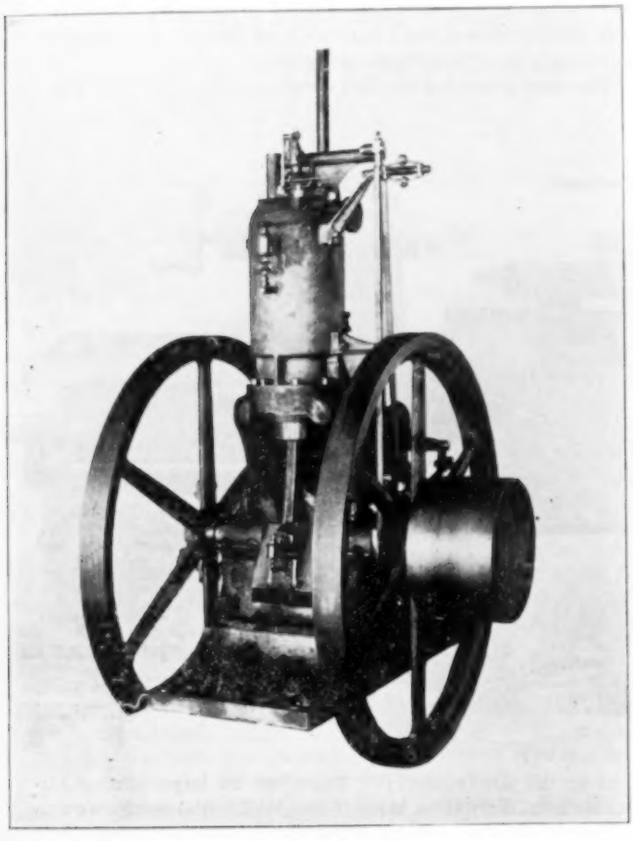
C. M. Schwab, superintendent of the Homestead Steel Works, has made an offer to the Homestead school board to endow an industrial school, equip it with tools and pay the instructors. The offer has been accepted by the board, and a committee appointed to confer with Mr. Schwab to carry out details.

D. B. Carse, of Greenlee Bros. & Co., Chicago, has just returned home from a three months' trip in Europe.

G. W. Scott, M. E., has been appointed to the position of mechanical engineer for the Pullman Car Works, at Pullman, Illinois.

DUPLEX GAS ENGINE.

The results of several years of investigation and experiment, at a time when the employment of gas as a motive power is having the closest study by the mechanical world, are presented in the Duplex gas engine manufactured by the New Castle Gas Engine Co., of New Castle, Pa. The designs have not copied prevailing forms of construction, but in a number of particulars have made departures from the usual practice. The upright engine is the type selected, in view of the fact that many of the situations to which gas engines are especially adaptable require economy of floor space. Other points to which attention is directed by the inventors are lightness, rigidity of base, capacity and proportion. The increased capacity is due to the use of an auxiliary cylinder, which exhausts the spent charge and draws in a fresh one at each stroke of the piston, thus, if necessary, getting an impulse at every revolution. Two fly-wheels are used, with a view to improved balance and an equal division of strain and wear on both bearings of the crank-shaft. The aim in the construction of the governor has been to secure positive, sensitive and reliable regulation. The speed of the Duplex engine can be changed from 40 to 300 revolutions a minute while running, by varying the pressure on a spring connected with the governor. This may be done at a distance from the engine. Air and gas valves are of the lift disc poppet form. They are raised and lowered at the proper time by a cam on the crank-shaft. Gear-wheels are entirely dispensed with.



DUPLEX GAS ENGINE.

The Duplex engine is started by a half turn of the fly-wheel. It is stated that the 25 h. p. engine can be started by one man. For ignition, the hot tube is employed, the composition tubes furnished lasting from six to eight months.

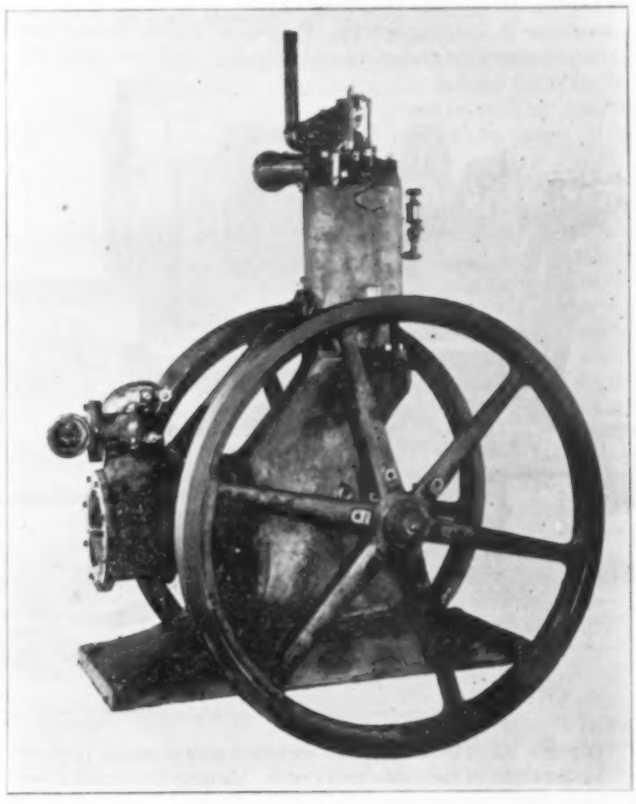
In the shops of the manufacturers of this engine a horse power is generated with 10 cubic feet of natural gas per hour. This is accomplished by withdrawing the entire old charge from the power cylinder, replacing it with a fresh one at each revolution. One of the users of the Duplex engine writes the makers that a month's bill for natural gas for a 10 h. p. engine was $4 28. The following machinery was driven 10 hours a day: One 16 in. rip saw, speed 3,200 rev.; one shaping machine, speed 4,700 rev.; one emery wheel, speed 1,400 rev.; one wire straightener, speed 3,800 rev.; one drill press; one 36 in. band saw, speed 400 rev.; one No. 3 forge fan blower, speed 2,500 revolutions.

PRODUCTION OF OPEN-HEARTH STEEL IN 1895.

We present below the statistics of the production of open-hearth steel ingots in the United States in 1895 as gathered by General Manager Swank, of the American Iron and Steel Association, and published in the current issue of the *Bulletin*. The statistics do not separately classify steel made in the open hearth and that made by the basic process. Direct castings are included with ingots in the figures. The production of open-hearth steel ingots in the United States in 1895 was 1,137,182 gross tons, against 784,936 tons in 1894, an increase of 352,246 tons, or over 44 per cent. The following table shows the production of open-hearth steel ingots and direct castings by States in the past four years:

STATES—GROSS TONS.	1892.	1893.	1894.	1895.
New England	18,620	24,759	26,304	36,733
New York and New Jersey	19,511	17,591	21,363	32,723
Pennsylvania	551,010	616,516	659,669	904,352
Ohio	60,834	50,385	54,182	75,637
Illinois	19,914	28,639	23,218	43,501
Other States				38,757
Total	669,889	737,890	784,936	1,137,182

The open-hearth steel made in 1895 was produced by 64 works in 11 States—New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania, Kentucky, Ohio, Indiana, Illinois, Missouri and California.



SIDE VIEW OF 25 H. P. ENGINE.

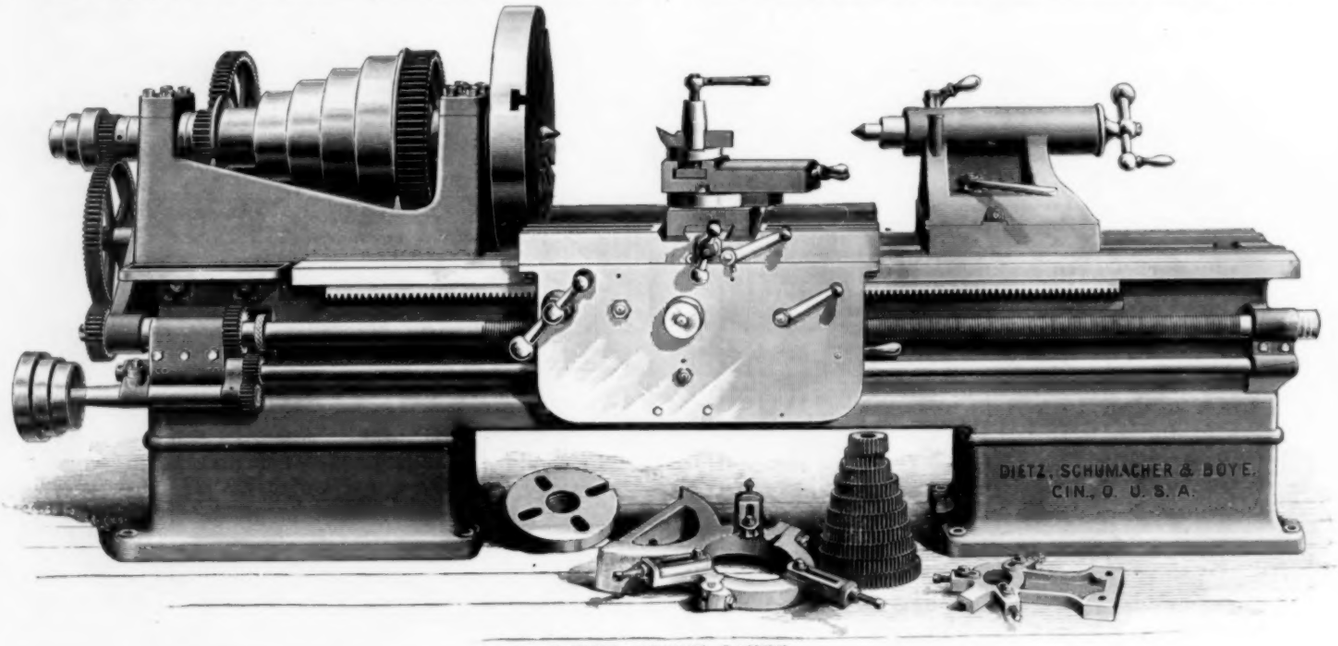
Our production of Bessemer steel ingots in 1895 amounted to 4,909,128 gross tons. Adding this production to that of open-hearth steel in 1895, we have a total production of Bessemer and open-hearth steel in that year of 6,046,310 tons.

BIDS were opened before the Circuit Court of Will Co., for the property of the Enterprise Co., Joliet, Ill., April 8. There were two bids presented, one from the Illinois Steel Co. for $100,100, and one from the Consolidated Steel & Wire Co., for $101,157.75. Judge Otis, of Chicago, and George S. House, of Joliet, who represented the holders of mortgages against the concern, did not want the bids accepted, claiming they were too low. The court heard the statements of the attorneys and gave them and all other attorneys until 10:30 A. M., April 11 to file their objections to the bids. The receiver expected to give the Consolidated Steel & Wire Co. possession Monday, April 13. It is probable that the wire and nail machinery shipped last week from the Cleveland plant of the Consolidated Steel & Wire Co. was sent to Joliet to be installed in the plant just purchased.

26-INCH ENGINE LATHE.

The tool shown in the illustration has been designed with a view to large output, having regard at the same time to the quality of the work. The head stock is massive, is fitted with bronze bearings and crucible spindle of large diameter, and it is made hollow, either for the purpose of driving out the center, or for passing the stock through. It has a five-step cone for 3¼-inch belt, is powerfully back-geared, and has the gearing for cutting screws direct, as well as the feed cone for operating the carriage. The tail stock is heavier than usual and is fitted with a spindle for long length of travel, and provided with a tightener for taking up wear. The carriage is longer and deeper than usual, being carried a little above the V's which the tool block moves, in order that the T seats may be of special strength. A groove is planed into the solid part of the carriage to receive the apron, making it as near a part of it as possible, so as not to depend upon the screws for holding the apron.

The reverse movement for carrying the feed in either direction is in the apron, and mechanism has been provided so that the half nuts can not be engaged until the feed is disengaged. Neither can the feed be engaged by any possibility while the machine is cutting screws. Pulling a button forward one inch engages the cross-feed and pushing back one inch disengages it. There is also an eccentric clamp, which is shown to the right of the cross-feed crank. Moving this crank downward locks the carriage firmly while the cross-feed is at work. A change of feed, in addition to the three-step cone may be had, by the gearing shown, in connection with the feed cone, so that either fine or coarse feeds may be obtained independenily of the lead screw. Another prominent feature is the bracket to which these gears are fitted. This swivels on a pivot to which it may be tightened, and is intended to keep the feed belt just sufficiently tight to carry the feed properly. The dimensions are as follows: Front bearings, 4⅜ in. diameter, 7 in. long; back bearings, 3½ in. diameter, 5½ in. long; nose on spindle, 3⅛ in.; hole in spindle, 2⅛ in.; centers conform to Morse taper No. 5; swings over ways, 26½ in.; swings over carriage, 16 in.; distance between centers, 3 feet, of 8-foot bed. The cone has five steps for 3¼-inch belt, largest 16 inch diameter, smallest, 7 inches. The speed of the countershaft is 120 revolutions. The tool will cut threads from two to 13 inclusive, including 11½-inch pipe thread. Its weight on a 12-ft. bed is 8,500 lbs. The manufacturers are Dietz, Schumacher & Boye, of Cincinnati.



26-INCH ENGINE LATHE.

THE lot of 10,000 tons of rails for the Japanese Government, made by the Carnegie Steel Co., Ltd., was shipped on the 4th inst. from Baltimore to Tokio.

PIG iron warrant stocks April 10 were 107,800 tons.

SOUTHERN IRON SHIPMENTS TO ENGLAND.

The following statement by Thos. Seddon, president of the Sloss Iron & Steel Co., Birmingham, Ala., to the *Manufacturers' Record* is in line with what Mr. James Bowron, treasurer of the Tennessee Coal, Iron & Railroad Co. wrote *The Iron Trade Review* last year about the sample shipments to England, made by the Tennessee Co. In some quarters the Sloss Iron & Steel Co.'s recent sales to English consumers were put as high as 3,000 tons:

"There is no significance to be attached to our shipment of pig iron to England. We shipped two small lots of 250 tons each as samples to pig iron brokers, who wanted to have it used over there to see whether anything could be done with our iron abroad, and as under the very depressed times we are now having there is an apparent profit between the Birmingham and the England markets, provided we can secure a vessel going abroad light, and it just so happens that owing to light shipments of cotton several vessels wanted stiffening, we were enabled to get an abnormally low rate of freight, which allowed us to make the shipment. Of course, we are willing to have the experiment made to see if anything in the future will develop from it, but I have no hope that any considerable business is possible with the other side."

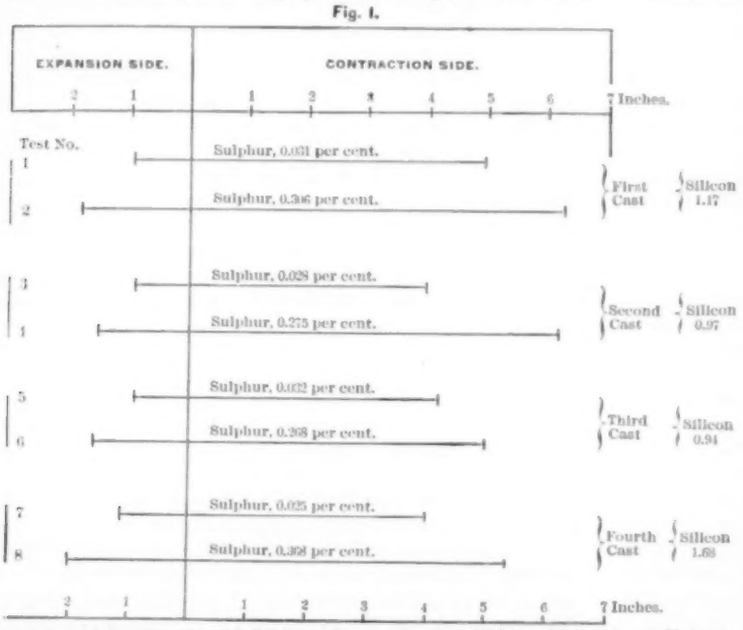
The same paper has this late communication from Mr. Bowron on the same subject: "There are no large sales of Alabama iron likely to be made in England, for although we can, at our lowest record of prices, put iron in certain ports a little below the parity of English quotations, it would manifestly not be a profitable business to attempt to cultivate—it would not pay for the trouble. There is just about room at to-day's prices for Alabama iron to scrape in and make a reasonable profit at such points as Genoa, Barcelona, Hamburg and Bremen, and, perhaps, Havre and Lisbon, and there certainly would be not only a fair but a good return on shipments to such points as Tokio and Melbourne if we had control of the tonnage. It is in this respect that the English system of subsidized mail steamers gives a great advantage to English commerce and industry, as it opens the way for certain shipment at stated schedules and reasonable freights to every import-and market. There is not quite the same room for export of Alabama iron that there was a year ago, because prices are not quite so low as they were then. It is a question, however, whether a combined effort, if made by several of the Southern companies, might not be successful. There is some idle plant in the South which might be put to work cheaply, reducing the fixed charges of those stacks which are running, and if such additional business were put in at cost price and the iron contributed ratably by a number of companies, there might be a large quantity of it delivered at competitive foreign ports at prices that would undoubtedly go below the ability of our English friends to meet."

THE EFFECT OF EXPANSION ON SHRINKAGE AND CONTRACTION IN IRON CASTINGS.*

BY THOMAS D. WEST, SHARPSVILLE, PA.

The fact that iron expands when heated, until fusion takes place, and that molten iron is consequently less dense than solid iron of the same grade is now universally admitted. It was proved by the extensive experiments of Mr. Thomas Wrightson, reported in the first volume of the *Journal of the Iron and Steel Institute* (1890 and 1891), and, in a manner, is illustrated in heavy founding by the shrinkage of the molten metal, which must be "fed" in order to obtain solid castings. This decrease in volume requiring "feeding" while the metal is still liquid I call "shrinkage," applying the term "contraction" to the decrease in volume which takes place after solidification, while the iron is cooling to atmospheric temperature. The light-work founder not having the opportunity to make heavy castings, in which shrinkage can be observed is apt to confound the two; but they are in fact distinct, and are separated by an act of expansion, which takes place at the moment of solidification. The fact of this expansion was first practically demonstrated by Mr. John R. Whitney, of Philadelphia, Pa., whose experiments are recorded in the *National Car and Locomotive Builder* of May, 1889.

Fig. 1.



Experiments recently made by the writer indicate that there is a constant relation between this expansion and the preceding shrinkage and forcibly demonstrate the necessity of "feeding" a casting to make its interior solid. This is a matter with which all makers and users of castings have experienced difficulty. The founder being heretofore unable to define correctly the principles involving the urgent necessity of "feeding" has failed to impress the molder with its importance in making sound castings.

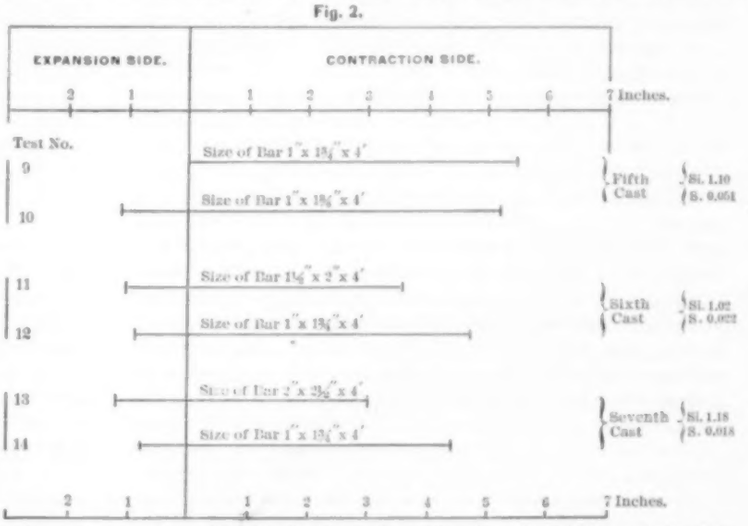
Heavy-work founders and molders know that hard grades of iron shrink much more than soft grades, a fact for which no satisfactory explanation has heretofore been given. By recent expansion experiments I have discovered that hard grades of iron expand more at the moment of solidification than soft ones. Fig. 1 is a diagram recording four such experiments.

The manner in which the automatic records were obtained will be described further on. It is sufficient to say at present that the scale of inches in the diagram measures the length of travel of the pencils on the long recording-arms of the apparatus employed, not the actual length of expansion. The end of the short arm of each lever, recording actual expansion, travels $\frac{3}{32}$ inch for one inch traveled by the pencil and the length of the test-bars being 48 inches, one inch of the expansion or contraction record represents an actual expansion or contraction of .3 in 1536, or 0.195 per cent. For the purposes of these experiments, however, the actual expansion or contraction was not required. The significance of the diagrams (Figs. 1 and 2) is qualitative and comparative; and for this use of them the reading of the pencil-travel in inches is accurate, the apparatus and operation being the same in all the tests recorded. With this explanation I return to Fig. 1.

In each of the four casts shown, two test bars 1 by 1¼ inches in section and four feet long, were cast "open sand" side by side in the same mold. Tests Nos. 1, 3, 5 and 7 were poured from the respective ladles which brought about 100 pounds of the iron direct from the cupola. These tests comprised the softest iron of each cast and had the least expansion and contraction as is shown by the diagram. For tests Nos. 2 4, 6, and 8 the grade of the iron was changed, by means of pouring about half of the hundred pounds contained in the ladle coming direct from the cupola into an empty ladle, the bottom of which was covered with about ¾ of a pound of brimstone. The metal in the ladle having the sulphur was then agitated with a half inch wrought-iron rod until fuming ceased, after which all dross was skimmed from the surface, when each ladle was poured into its respective test-mold. The addition of sulphur hardened the iron in these tests, thereby causing the increased expansion and contraction shown in the diagram.

In Fig. 2, tests Nos. 9 and 10 illustrate another discovery made by this method of comparative tests, namely, that where free expansion is prevented, a greater contraction is effected. Test-bar No. 9 was cast between iron ends, so arranged that the power of expansion was not sufficient to extend the distance between them, whereas No. 10 had sand ends to compose the mold, which gave full freedom for expansion, the same as in all the other tests displayed in Figs. 1 and 2. The fact that hard grades of iron expand more than soft ones, and the fact that retarding expansion gives rise to a greater contraction than where free expansion is permitted are important as suggesting for works making such specialties as chilled rolls, car wheels, etc., in which heavy losses are often experienced through chill-checks and cracks, the advisability of adopting expanding and contracting "chills" wherever such may be practicable.

Fig. 2.


EXPANSION SIDE.
CONTRACTION SIDE.
2 1 1 2 3 4 5 6 7 Inches.
Test No.
9 Size of Bar 1" x 1⅝" x 4'
10 Size of Bar 1" x 1⅝" x 4'
Fifth Cast
Sl. 1.10
S. 0.051
11 Size of Bar 1⅝" x 2" x 4'
12 Size of Bar 1" x 1⅝" x 4'
Sixth Cast
Sl. 1.02
S. 0.022
13 Size of Bar 2" x 3½" x 4'
14 Size of Bar 1" x 1⅝" x 4'
Seventh Cast
Sl. 1.18
S. 0.018
2 1 1 2 3 4 5 6 7 Inches.

Tests Nos. 11, 12, 13 and 14, in Fig. 2, illustrate the expansion and contraction of different sizes of bars poured in pairs from the same iron. These tests show that large bars expand so as to increase their interior space more than small ones, thereby calling for the greater "feeding" in massive castings. These tests indicate also that light bars contract more than heavy ones, an element not to be overlooked in designing castings so as to avoid internal strains as far as practicable.

The writer's "open-sand" method of casting test-bars affords the means of making comparative tests under varied

*Contribution to the discussion of the Physics of Cast Iron, at the Pittsburg Meeting of the American Institute of Mining Engineers, February, 1896.

conditions and gives an excellent opportunity to observe characteristic phenomena at the moment of solidification, etc.

In casting test bars of hard iron, a pronounced shrinkage along the upper surface is often noticed during the period of expansion; and often before expansion is over there may be seen through shrink-holes at the hottest part of the bar (namely, at the point where it was poured) that the interior is still liquid, showing that it is not necessary that the whole body of the casting shall solidify before expansion takes place. In this phenomenon, we perceive also the simultaneous action in the casting of two opposite tendencies, shrinkage going on in some parts, while expansion is occurring in others.

It is the general impression among molders and founders, that the hotter the iron is poured, the more it will shrink, that is, the more the casting will require to be "fed." This is an error into which the molder has fallen by reason of the longer time occupied in the cooling or shrinkage of the "hot-poured" metal, and consequently the longer period of "feeding." The total addition of iron required in the "feeding-heads" is no greater with "hot" than with "dull" poured iron, unless the "hot" poured metal has more largely penetrated, fused or strained the walls of the mold.

Numerous experiments have failed to show me any effect produced upon the total expansion by changes in the temperature of the metal when poured. Such an effect would not be naturally expected, since the expansion begins only with solidification, and the temperature of solidification, it is reasonable to say, is always the same for the same grade of iron, under the condition of these tests; so that, however "hot" iron may have been poured, it will always have a certain temperature when it begins to expand. It is this independence of the extent of expansion as regards the pouring-temperature which constitutes the chief ground of the writer's faith that expansion may be employed further on, when more is known of it, to determine rapidly the grade of cast iron or other metals. But it is, of course, clear that expansion will take place sooner in a "dull" poured bar than in a "hot" one; and again, a light body will expand more quickly than a heavy one, as I have proved by my tests. The length of the period of expansion varies with the size of the casting. The more massive the casting, the longer the period of expansion. For the bars shown in Figs. 1 and 2, the expansion lasted from one-half to one minute in the smallest bars, and in the largest bars, from three to five minutes. The writer would like to learn of expansion tests made upon steel castings, etc. Since steel exhibits about twice the contraction of cast iron and likewise great shrinkage, there is reason to expect that a very large expansion would be found in steel, at the time of its solidification.

The relation between the shrinkage and the expansion of solidification may now be indicated. The writer's view is that the apparent shrinkage of liquid metal so familiar to heavy founders is not due chiefly to a change in the specific gravity of the liquid metal as it passes to a solid state, but largely to the effect of the expansion of the solidifying parts of the casting. That is to say, an outer shell of the casting being first formed, its expansion at the moment of solidification necessarily enlarges the interior space to be occupied by liquid metal; and either additional liquid metal must be applied or else cavities and shrink-holes will be found in the interior of medium and heavy castings, by reason of the progressive accretion of the solidifying metal upon the parts already solidified. Such cavities would, on this hypothesis, be likely to be most abundant in the portions which solidified last; and that this is in fact the case, practical founders are well aware. Cavities are very liable to occur in the interior of massive castings, and even when castings are properly proportioned, the portion around the "gates," which convey the metal to the mold, is often very likely to be porous or to exhibit shrink-holes, due to the circumstance that the metal solidifies last at these points, and to the attraction of solidifying particles to the already solid mass. This hypothesis explains also the fact that in heavy castings poured "hot," shrinkage is not often exhibited in the "feeding heads" until long after the pouring, and that when it does commence (which is not before some expansion has taken place, due to parts solidifying), it is often so rapid as to require, for a short period, constant additions of molten metal.

Expansion at the moment of solidification, being thus the cause of shrink-holes in castings, the practice (not uncommon among molders) of placing "risers," not much larger than lead-pencils, so to speak, on massive castings, thinking thereby to make them solid, is to be discouraged as useless. It follows, moreover, that a casting should be "fed" until expansion is ended. It is not while a metal looks "hot" or fluid in a "feeding-head" that attention is specially necessary to secure a solid interior; it is when the metal is thickening or "freezing" in the feeding-heads that the greatest attention should be paid to the "feeding." It is a general practice among molders, at present, to let their feeding-heads "bung up," at a time when the greatest effort should be made to keep them open, so as to insure a solid casting. It is at this time, that expansion is taking place, to enlarge the surface-area, and consequently the interior volume of a casting, thereby causing the hottest or most fluid portion of the casting to be robbed of metal, which must be supplied, in order to prevent shrink-holes at all such points.

According to the view here presented, it will be also easy to understand that the resistance offered by the mold may often effect the expansion and shrinkage as well as the subsequent contraction. Whether the power of expansion is as great as that of water in becoming frozen, is, as far as I know, undetermined. I do know that by casting between iron yokes or flask-ends, the longitudinal expansion of the bar may be prevented, as is seen in Test No. 9, Fig. 2. In such a case, of course, it is natural to suppose that the expansion must be in some other direction, and it may increase to a smaller degree the interior space necessary to be supplied with molten metal by feeding. The heat-conducting capacity of the mold, as determining the rate of solidification, may also effect the apparent result. Thus, a casting made in an "iron chill" mold will show less shrinkage than if the same iron had been poured into a sand mold, because in the latter case, the solidifying iron would have time and opportunity, by reason of the nature of the mold, to more expand it outward, thus increasing the interior space to be supplied with molten metal as already explained.

To return to the fact discovered by the writer, that hard grades of iron expand in solidifying more than soft grades, it may be said that this is contrary, not only to the general impression, but also to the current explanation of the fact of expansion, which would ascribe it to the segregation of graphitic carbon. If this were the controlling cause, we should expect soft irons, which exhibit after solidification, more graphite, to show the greater expansion.

The formation of graphite is confessedly promoted by silicon and hindered by the metalloids which harden the iron. When these metalloids are present in such proportions as to overpower the effect of the silicon, combined carbon, instead of graphite, is produced in the solidified metal, and the individual grains, crystals, or structural elements of the cast iron are consequently smaller and more densely packed in hard than in soft grades of such iron. Expansion (and, perhaps, also contraction) would be, therefore, exhibited by a larger number of such structural elements in a given volume of metal. This may explain the greater expansion shown by the hard grades in Tests Nos. 2, 4, 6 and 8 in Fig. 1, where the largest percentages of the antagonistic constituents, silicon and sulphur, are presented.

But any theory on the subject may be premature. Far more important at this time is the fact itself, which affects so directly our foundry practice. I attribute the failure to detect it heretofore, to the circumstance that in the every-day work of the founder, the expansion of solidification does not force itself upon his attention. The shrinkage of the liquid mass, requiring "feeding," is obvious enough; and so is the final contraction of the solid mass, for which allowance has to be made in the pattern. But the intervening expansion, not being marked by the final contraction, has been overlooked.

I may here observe that the tests illustrated in Fig. 1 refute the opinion heretofore advanced, that the silicon contents of an iron can be defined from the final contraction of a casting or test-bar. In all the bars of Fig. 1 the silicon percentage was practically constant. The variation in contraction, therefore, certainly justifies the assertion that the amount of silicon cannot be thus determined. In fact, the contraction will simply indicate the "grade" of an iron and no more. The metalloids producing this "grade" can only be determined by analysis.

The "grade" of a cast iron, as I use the term, is a practical name, familiar to heavy founders, though perhaps not capable of precise scientific definition. It is characterized by the degree of hardness, and incidentally by accompanying properties of contraction and of strength. Within the range of ordinary foundry practice, sulphur and silicon are the two elements most effective in changing the "grade" of cast iron—the two operating with contrary tendencies, and one part of sulphur being equivalent in effect to from eight to 12 parts of silicon. This statement, ignoring, as it does, the effect of other metalloids, is not presented as comprehensive and exhaustive, but may be useful, nevertheless, as the expression of the practical experience of a founder.

It has been maintained that it is difficult to make cast iron absorb sulphur and that the founder has no need to fear sulphur in general founding. In the tests shown in Fig. 1, the amount of sulphur in the iron was easily increased by the method described, as is proved by the subsequent analysis. At all events, I feel sure that up to 0.3 per cent, sulphur can be easily present in cast iron containing about 1.5 per cent of silicon, which is a percentage of silicon often permissable and practicable as a maximum in light castings, where the sulphur can be kept below 0.06 in the castings produced. As 0.2 per cent of sulphur is sufficient to injure or ruin almost any casting made for other purposes than sash-weights, the ability of cast iron to absorb 0.3 per cent of sulphur forcibly illustrates the great reason which the founder has to fear sulphur in fuel, high sulphur iron, and to avoid any method in melting, favorable to the absorption of sulphur by iron in cupola practice. These considerations are applicable also to the making of iron in the blast furnace.

[The concluding portion of the paper, giving illustrations and detailed description of the apparatus employed by Mr. West in making the tests referred to will be given next week.—Ed.]

Publications Received.

A substantial catalogue in black cover, with bronzed title plate, has been prepared by the Lewis Foundry & Machine Co., of Pittsburg, illustrating the heavy mill shears of which it makes a specialty, and the roll lathes, hydraulic machinery, housings and trains and other rolling mill and steel works equipment. Illustrations are attractive and each view is accompanied by a brief description. Half-tones and letter-press are in tint and the mechanical features of the work are excellent. The size is unusual, 6¼x9¼ inches.

Four pamphlets have been prepared by the Backus Water Motor Co., of Newark, N. J., to illustrate and describe its various products, one being devoted to water motors, another to electric ceiling fans, a third to rotating and exhaust ventilating fans, and a fourth to the Backus gas engine, which employs gas or gasoline. In the small powers the gas engine is made both vertical and horizontal. Of the horizontal engine views are given of various sizes up to 100 h. p. The governor of the Backus engine is so arranged that speed can be changed while running, by touching a thumb screw.

A specimen of handsome calendar work is the series of ribbon-tied prints, each bearing a clear and well-finished half-tone view, just put out by the National Engraving Co., of Cleveland. The Cleveland & Buffalo Transit Co. has also made use of a calendar as a method of publicity. A view in colors of the steamer "City of Buffalo" leaving Cleveland harbor makes an attractive head-piece.

"B '96" of the Buffalo Forge Co.'s catalogue is the first publication of this company devoted to engines, though center crank automatic horizontal engines have been built at the Buffalo plant for a number of years. Until the recent enlargement, the facilities of the company were taxed to their utmost in this department. The automatic cut-off engines described in the pamphlet are peculiarly suited for dynamo driving, either by belt or direct connection, in central stations, industrial plants, and in office buildings and other structures.

A. SORGE, JR., M. E., Chicago agent of the Cochrane heaters and separators, made by the Harrison Safety Boiler Works, has sold Lyon & Healy, of Chicago, a large feed water heater. Mr. Sorge has also recently sent in to the Harrison works orders for two oil-ammonia separators and several live steam separators.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Dunkirk Locomotive & Car Repairing Co. has been incorporated at Dunkirk, Jay Co., Ind., with $100,000 of common and $100,000 of preferred stock. The company proposes to erect a manufacturing establishment, in which locomotives, cars and all sorts of devices used by railroads are to be made. The directors of the company are James Irvine, George B. F. Cooper and Charles A. Ball of New York City.

The Universal Construction Co. has been incorporated in Campbell Co., Ky., with a capital stock of $50,000, to manufacture and sell iron and steel, structural material, bridges, etc., by M. J. Brown, J. P. Miller and W. E. Bush. Among the stockholders are Robert W. Hunt and W. R. Sterling of Chicago.

At the office of the Supervising Architect, Washington, D. C., sealed proposals will be received until 2 p. m., May 5, 1896, for all the labor and materials required for the roof covering, skylight, drain pipes, etc., for the United States post-office, court house and custom house building, at Milwaukee.

The American Electric Vehicle Co. has been incorporated at Chicago, with a capital stock of $250,000, to manufacture horseless vehicles, by F. S. Culver, W. W. Robinson and D. M. Carter.

The Easton (Pa.) Foundry & Machine Co. has been incorporated with $20,000 capital. The directors are A. G. Nesbit, G. F. Nesbit, F. G. Ormsby and others.

George Wright has leased a floor of the Amelotte bldg., at Worcester, Mass., and will fit it up as a machine shop.

C. P. Willard & Co., 197 S. Canal st., Chicago, want to buy a second-hand steam hammer, under 1,500 pounds.

J. L. Diven & Co., Rapid City, S. D., want to buy a second-hand iron lathe, 18-foot bed.

New Construction:—

The Sprinkle Pulley Co., of Pennsboro, W. Va., will erect a building two stories, 55x126 feet, of frame, with metal roof; engine and boiler room of brick, 34x36 feet.

The Shiffler Bridge Co., Pittsburg, has a contract for the plant of the American Weldless Steel Co., Toledo, O. It will be 115x215 feet.

The Pope Mfg. Co., Hartford, Conn., will erect a new steel tube plant including power house, accumulator house, coal storage, etc.

Charles Lionhard, of New Ulm, Minn., has leased ground from the city and will soon build a brick foundry, 50x100 feet.

The new boiler works of the Casey & Hedges Co., Chattanooga, are nearly ready for the machinery.

Work will begin at once on the new plant of the Fowler Radiator Co., Johnstown, Pa.

Additions, Enlargements, Removals, Etc.:—

The Slaymaker-Barry Co., of Lancaster, Pa., manufacturer of locks and builders' hardware, is negotiating for a site and for a bonus, with a view to removing to another point. Johnstown and Connellsville, Pa., are considering the question. The company's assets are estimated at $132,000.

An Elwood, Ind., dispatch says that an addition will be made to the American Tin Plate Co.'s plant—two new mills and 10 stacks. The additions will be in operation July 1. The company made a contract for its steel early in the year and is not interfered with by the advance in billets.

Dietz, Schumacher & Co., manufacturers of machine tools, Cincinnati, O., were on April 1 succeeded by Dietz, Schumacher & Boye. F. W. Boye, Jr., has been connected with the C., C., C. & St. L. Ry. The new firm are increasing the size of their plant to double its present capacity.

Baker & Sherlin, founders and machinists at Saratoga Springs, N. Y., will build an extensive addition to their plant. Part of the addition will be equipped as a brass foundry.

The Standard Horse Nail Co., of New Brighton, Pa., will erect an addition 50x248 feet for raw material, and an addition 50x100 feet is being made to the machine shop.

The Salem Iron Foundry Co., of Salem, Mass., has purchased

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There are many kinds. We're advocating insurance for engines from water, and insurance for Boilers from oil.

First Case:—Even if your Boilers don't prime—or are not forced—or your main steam line is not very long—or there are no pockets in it—there will be a certain amount of water present in the steam when it gets to the engine, which will lessen the economy of the engine. Therefore you can get interest on the cost of a Cochrane Separator which will keep out this water—and at the same time get your engine insurance against damage from water—WITHOUT COST.

Second Case:—We can take oil out of steam. If Exhaust Steam because contaminated with oil is unfit for your use, then a Cochrane Separator will pay a big return on its cost.

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WHARTON-HARRISON SAFETY BOILERS.

HARRISON SAFETY BOILER WORKS,
MANUFACTURERS. PHILADELPHIA, PA.

the Murphy wharf property in that city and will build a big plant there immediately.

At Toledo, O., the H. A. Lozier Mfg. Co. has arranged for the erection of an addition for the manufacture of weldless cold-drawn steel tubing.

The addition recently made by the Ohio Tube Co., Warren, O., has given place to 100 more men and the output is increased accordingly.

Howland & Son, Pontiac, Mich., have made a number of improvements in their foundry and machine shop, conductive to a larger output.

The Canton Rolling Mill Co., of Canton, O., has built a 50-foot addition to the main building and two new annealing furnaces.

Fires and Accidents:—

Wallace Bros. & Graves' machine shops and foundry at Lafayette, Ind., burned April 8. The loss is estimated at $25,000, and there is $7,000 insurance. All of the company's patterns were burned with three new Raymond engines.

The general office and club house of the Westinghouse Air Brake Co., at Wilmerding, Pa., were destroyed by fire April 8. Loss $50,000, fully insured.

At Hollidaysburg, Pa., the Elanor Iron Works, operated by R. C. Mat & Co., of Harrisburg, was partly destroyed by fire; loss, $3,000.

F. Hartman & Co.'s foundry, at Grand Rapids, Mich., was damaged by fire March 30; loss about $1,200.

General Industrial Notes:—

Remarkable open-hearth practice is reported at the No. 1 furnace of the Phœnix Iron Co., Phœnixville, Pa., covering a period of exactly six working days of 24 hours each. The furnace commenced charging at 6 o'clock Sunday evening, March 29, and the 21st heat tapped and furnace bottom fixed Saturday afternoon at 5:55. The mix was one-third pig and two-thirds scrap, and owing to presence of high silicon in the pig, 1,000 to 1,500 pounds of ore were used on each heat. All the heats were run into dead soft grade, 0.10 to 0.12 carbon. The 21st heat was in the furnace only four hours and 50 minutes; this time being taken from the first metal charged until tapping hole was opened. The weight of the ingots made on this remarkable run was 463 long tons. The actual loss from metal charged to ingots produced was 6.6 per cent, but the weight of pit scrap and skulls reduced this to less than five per cent. All heats were charged by hand labor exclusively. This furnace was originally built for 15 tons capacity, and the charges subsequently increased without enlarging the furnace in any way.

The use of electricity in textile industries is found to give to textile machinery the perfect regulation essential to high grade production. One of the most recent installations has been made in the mills of W. J. Dickey & Son, Baltimore, by the General Electric Co. The electricity is generated by two 90 h. p. moderate speed generators, belted to a horizontal water wheel. The current is transmitted about 200 feet to the third story of a woolen mill where it will be used to operate motors and furnish light. In this third story 36 60-inch wool n cards and four mules are to be placed, the cards being arranged in three rows, thirteen to a row with a line of shafting to operate each row. The motors will be placed either on top of the roof beams or be suspended from the same beams by iron slings and will be connected to the line shaft by a belt. Two of these line shafts will be operated by two 25 h. p. slow speed motors. For the operation of the mules a 20 h. p. moderate speed motor will be connected to the shafting.

The contract for furnishing the entire steam power plant, exclusive of the boilers, for the Northwestern Elevated R. R. Co., of Chicago, has been given to the Edward P. Allis Co., of Milwaukee, Wis., through that company's Chicago representative, J. B. Allan, Home Insurance Building. The contract includes three horizontal, cross-compound, condensing engines of 2,500 horse power each, and one 1,200 horse power engine of the same type. The armatures for the electric generators will be built up on the main shaft of each engine. The contract also calls for the pumps, heaters, separators, and all steam connections and piping necessary to thoroughly equip this great plant. The power house will be located on the line of the road at the intersection of Fullerton ave. The Edward P. Allis Co. has also secured an order for a 1,200 horse power horizontal, tandem, compound, condensing engine for the Metropolitan Street R. R. Co., of Kansas City, Mo.

The Lackawanna Iron & Steel Co. produced at its South Works, Scranton, Pa., in 47 12-hour shifts during the month of March, 1896, 28,165 tons of ingots, being an average of 599 tons per shift of 12 hours. Eight ingots constituted one heat; the total number of heats made during the month amounted to 2,861, or an average of nearly 61 heats per 12 hours, weighing approximately 9 84 tons each. The average percentage of silicon in the cupola mixture was 2.12 and the fuel for melting the pig iron anthracite coal. During the week ending March 21, 726 heats were produced, amounting to 7,007 tons of ingots, or an average of 637 tons in 12 hours. Taking into consideration the large amount of ingots made, the high percentage of silicon in the pig iron used and the fact that the fuel for melting it was anthracite coal, it is considered that the results as shown above are very gratifying.

The stockholders of the Westinghouse Electric & Mfg Co., of Pittsburg, will hold a special meeting in that city on June 4 to vote on a proposition to increase the capital stock from $10,000,000 to $15,000,000. The object of the increase is to pay off the floating debt of $3,000,000 and to prepare for an increase of business. The circular calls attention to the advantageous agreement for interchange of patents with the General Electric Co., and states it will increase the profits of the company. Of the $10,000,000 authorized capital, about $9,000,000 has been issued. All of the new stock is to be of the same character as the present assenting stock, and the balance of stock which will remain after the delivery of the $3,000,000 of stock sold is to be issued from time to time by the directors of the company's business.

The Columbia Iron & Steel Works at Uniontown, Pa., which

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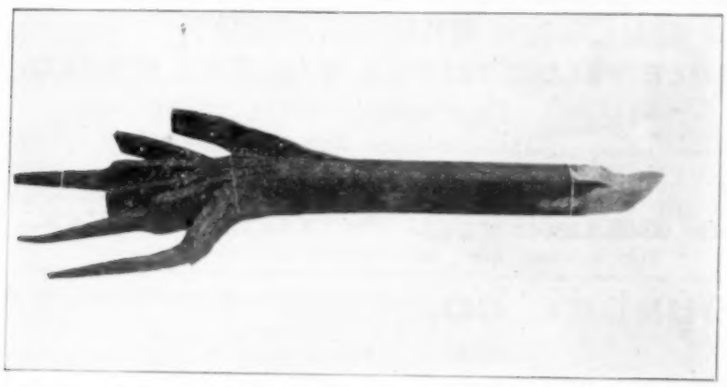

Represents six old American files welded together solidly at separate heats so that no trace of the teeth show in the stock. After the weld was made they were doubled back in the center and the end drawn down under the hammer into a solid bar of tool steel and a lathe tool made of the end.

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have been in the hands of a trustee of the first mortgage bondholders for the past two years, were purchased last week by Willis McCook, representing New York and Pittsburg capital. The plant will be remodeled and modernized. It was erected in 1887 by E. M. Butz, Christian Yeager and others and made a specialty of structural steel, operating outside the beam pool then in existence. It has two five-gross ton Bessemer converters, and its daily capacity in steel ingots is from 300 to 350 gross tons. It is intimated that the formation of the billet pool is the occasion of starting up the plant, and that among those identified with the new company that is to be formed are representatives of broker interests whose traffic in billets is practically cut off by the pool.

In U. S. Court, Judge Buffington has handed down a decision in the contest between the H. C. Frick Coke Co. and W. J. Rainey over certain coal lands. The two companies own what is known as the Beeson farm at Mt. Braddock. Some time ago Rainey filed a bill in equity to secure a partition of the property. The plaintiff owns one-third of the land and the dafendant company two-thirds. Rainey's Mt. Braddock mines join the property owned jointly by the parties, and pending a determination of the proceedings in partition he drove his headings horizontally from his Mt. Braddock mines to penetrate the Beeson farm. This brought a cross bill from the Frick company. The opinion just given allows the injunction prayed for by the H. C. Frick Coke Co.

The Solar Iron Works at Pittsburg has been taken out of

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1—15″ Smith and Mills Shaper.
1—10″x5′ Prentice Engine Lathe.
1 each 14″ and 15″x6′ Ames Engine Lathe.
1—16x5 ft. Bullard Engine Lathe.
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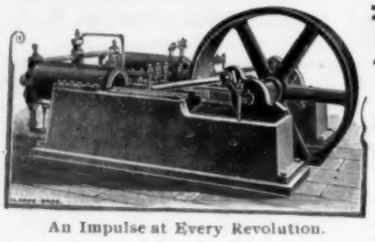

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the hands of the sheriff, and will likely be put in operation soon. This is the result of a settlement of the suit of Mrs. Elizabeth D. Clark against Mrs. Jane Clark, in which a verdict was given the former for $453,757.32. A new corporation will be formed to operate the plant, to be known as the Wm. Clark's Sons Co. This company will have a capital stock of $300,000, all of which is to be pledged as security for the payment of $300,000 to Mrs. Elizabeth D. Clark, who has agreed to accept that amount in full payment of her judgment of $453,757.32.

The Ashcroft Mfg. Co. has purchased of Jarvis B. Edson, 87 Liberty st., New York, the Edson recording gauge and alarm gauge and hereafter will be the sole manufacturers of this gauge. With its facilities for manufacturing and the long experience it has had in the manufacture of delicate instruments for measuring pressures, this company is well equipped to continue the manufacture of the Edson recording gauge. The gauges can be purchased from the Ashcroft Mfg. Co., 111 Liberty st., New York, or from any of its branch stores, 60 S. Canal st., Chicago; 424 Telephone Bldg., Pittsburg; or 47 Pearl st., Boston.

A few weeks ago note was made of the equipment of the large Drew-Selby plant in Ohio with electric motors by the General Electric Co. The same company is about to furnish electrical equipment for the Norway Shoe Shop Co., of Norway, Me. Seven non-synchronous multiphase motors aggregating 100 h. p. will be put in. The current will be taken from the 250 k. w. three-phase generator recently set up in its station by the Norway Electric Light Co.

The city council of Cleveland has decided to contract with Shields & Lauer, a Cleveland contracting firm, for 6,300 tons of cast iron water pipe at its bid of $18.15 per ton on cars and $18.25 for pipe delivered on the streets. The successful bidders decline to say from what pipe foundry their pipe will be purchased. They say that they have propositions from two or three concerns outside the pool and do not want the pool to thwart their plans.

The Elk Rapids Iron Co., Elk Rapids, Mich., is making preparations for resuming operations in the manufacture of charcoal pig iron. The furnace has been shut down for nearly a year, during which a large accumulation of pig iron has been worked off.

The Lackawanna Iron & Steel Co. is building roasting ovens at Scranton, Pa., at a cost of over $140,000. When they

are completed the roasting of the Cornwall ores will be done at Scranton instead of at Cornwall.

J. F. Seiberling & Co., Akron, O., manufacturers of the Empire mowers and reapers, who failed recently for $400,000, will probably be taken out of the hands of the assignee. A meeting of the creditors was held at Akron last week, and a proposition from the county was accepted to extend the time of the paper, the company to pay dollar for dollar, and a committee of the creditors to control the business until the debts are paid.

Six of the new hot mills at the New Castle Steel & Tin Plate Co.'s Works, New Castle, Pa., have been completed and put into operation. The remaining six are in process of construction, and it is expected that by July 1 all the extensive additions and improvements which are now being made to the company's plant will be completed. The works will then possess a capacity of about 2,500 boxes of finished tin plates a day.

Judge Vinje, in U. S. Circuit Court, has authorized Howard Morris, receiver of the West Superior Iron & Steel Co., to issue $50,000 in receivers' certificates to save the plant, valued at $3,000,000, from tax sale.

Titusville, Pa., people have subscribed $250,000 to be used in making loans to industrial works locating in the city. The committee of citizens having the matter in charge is deluged with propositions.

At Sharon, Pa., the Aschman Steel Co. announced a reduction in laborers' wages from $1.35 to $1.25 a day. The wages of skilled laborers will also be reduced, but individual contracts will be made.

The Ohio Steel Co., Youngstown, O., has resumed operations in full, and the order issued a short time ago for a 10 per cent reduction in wages has been recalled in view of the advance in billets.

At a meeting of the stockholders of the Cleveland, Lorain & Wheeling Railroad in Cleveland, April 10, it was decided to issue $1,000,000 in bonds, the money to be used for improvements of the road.

The Brook Iron Co., Birdsboro, Pa., posted notices last week of resumption of the nail factory April 13, after 12 weeks' idleness. The puddlers receive $2.75 a ton. They had refused to accept less.

The Rand Drill Co., 1329 Monadnock Block, Chicago, recently received an order from the Santa Fé Railroad for six air compressors, to be used in shops along the line of that road.

The Beaver Falls mills of the Consolidated Steel & Iron Co. turned out in March 7,808 gross tons of rods. This is considered the world's record for a single mill for one month.

The Westinghouse Machine Co. recently shipped a single piece casting weighing 40,000 lbs.

The Pennsylvania Railroad has placed another order for rails, to weigh 100 lbs. to the yard.

The Cole Furnace, at Sheffield, Ala., has gone into blast. It has been idle for several years.

Steam Yachts and Marine Machinery,

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

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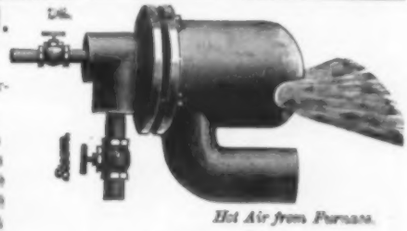

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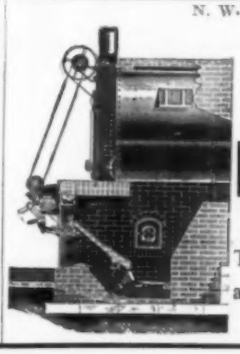

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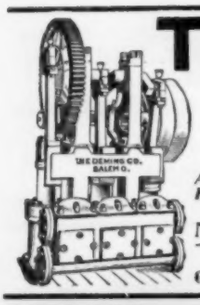

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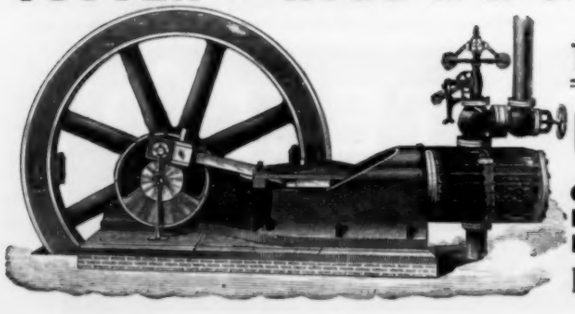

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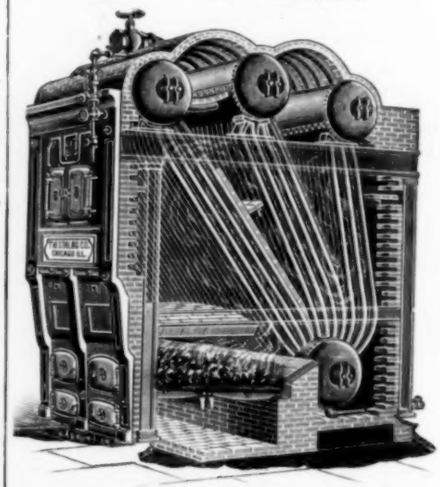

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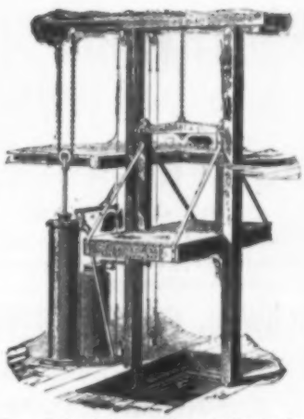

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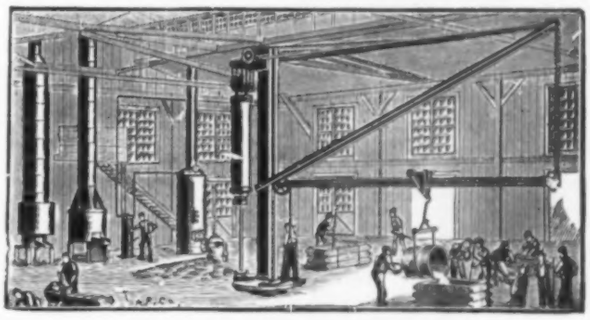

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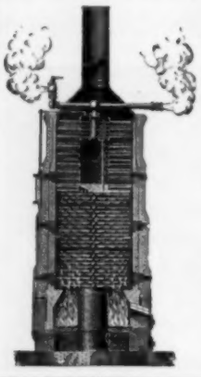

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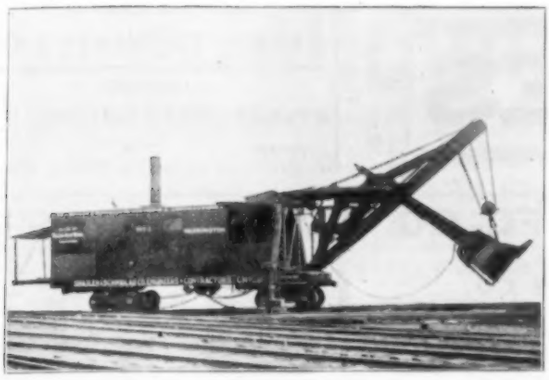

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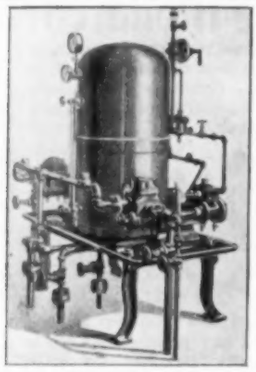

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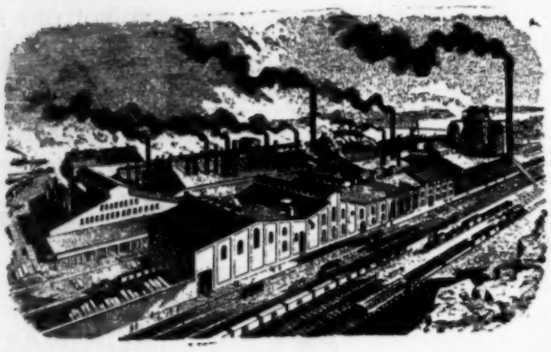

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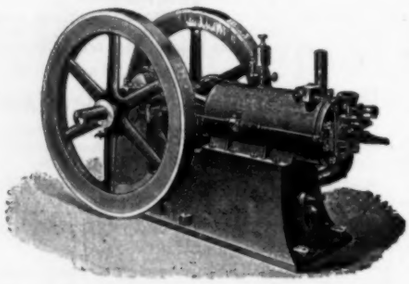

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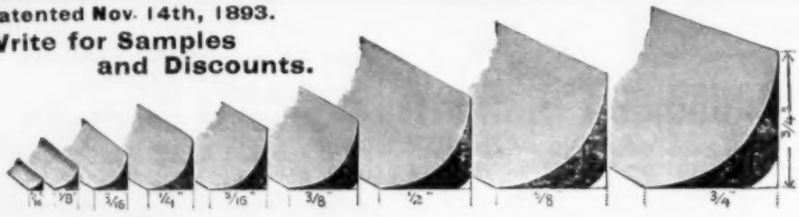

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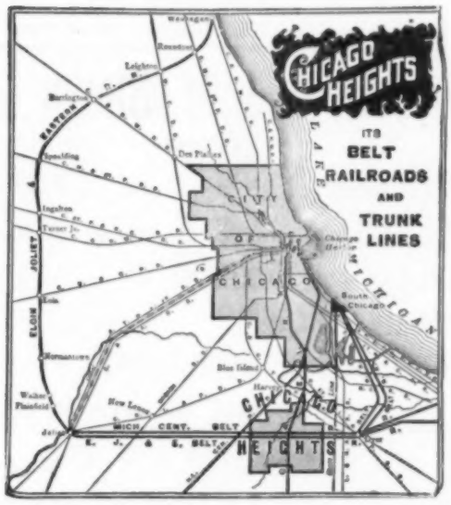

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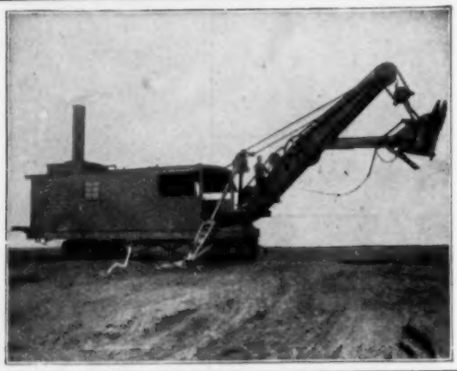

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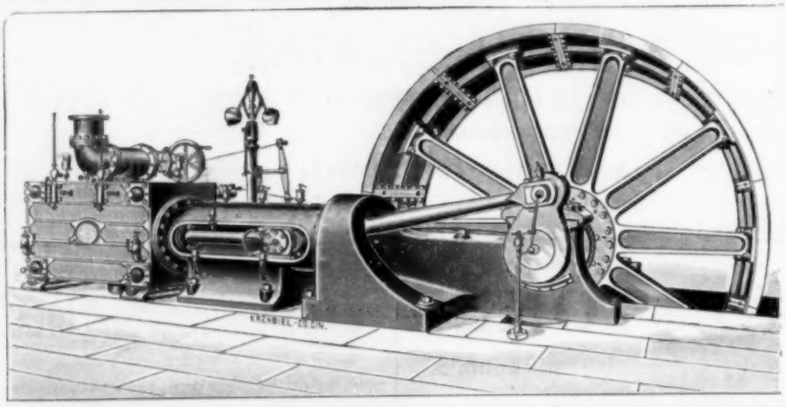

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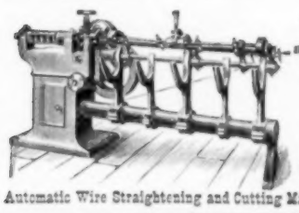

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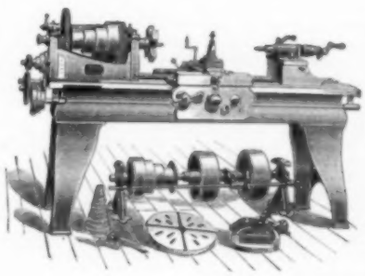

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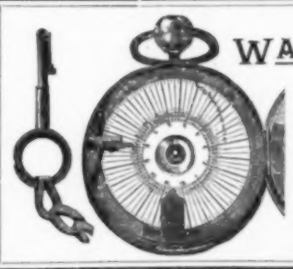

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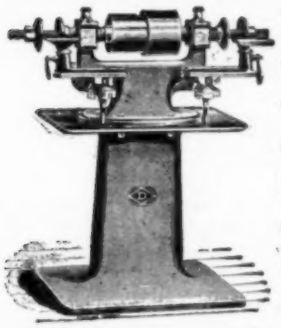

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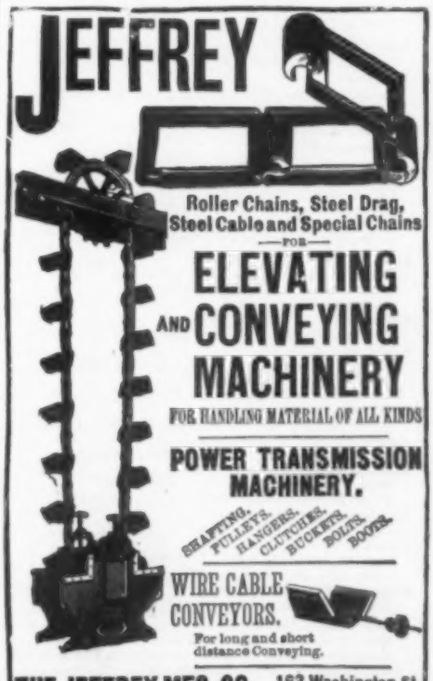

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American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
Link Belt Machine Co., Chicago, Ill.

Hoisting Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Hoisting Engines—
Vulcan Iron Works Co., Toledo, O.
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
Earle C. Bacon, New York City.

Injectors—
C. H. Besly & Co., Chicago, Ill.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Berlin Iron Bridge Co., East Berlin, Conn.

Iron Nails and Steel—
Weber & Co., Cincinnati, O.
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
Cambria Iron Co., Johnstown, Pa.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

Iron Ore, Bar and Pig Iron—
Pittsburg Steel & Iron Mfg. Co., Pittsburg, Pa.
Oglebay, Norton & Co., Cleveland.
Condit-Fuller Co., Cleveland.
E. C. Pope, Cleveland.
Forster, Waterbury & Co., Chicago, Ill.
Central Iron & Steel Co., Brazil, Ind.
Junction Iron & Steel Co., Mingo Junction, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.
Cambria Iron Co., Johnstown, Pa.

Iron Shutters and Doors—
The Cincinnati Corrugating Co., Piqua, O.

Iron Working Tools—
Prentiss Tool & Supply Co., Chicago, Ill.
Toledo Machine & Tool Co., Toledo, O.
H. Bickford, Lakeport, N. H
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.
C. H. Besly & Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
John Adt & Son, New Haven, Conn.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
The Wright Co., Lowell, Mass.
C. H. Haeseler & Co., Philadelphia, Pa.
The L. S. Starrett Co., Athol, Mass.
Skinner Chuck Co., New Britain, Conn.
Springfield Machine Tool Co., Springfield, O.
Harvey Hubbell, Bridgeport, Conn.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,

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The Largest and Most Completely Equipped Electrical Manufacturing Establishment in the World.

POWER, INCANDESCENT AND ARC LIGHTING, FROM THE SAME CIRCUITS.

We have purchased and are the **sole owners** of the patents issued to Nikola Tesla for the **Polyphase Alternating System,** now recognized to be the most successful system for lighting and power purposes.

We furnish complete lines of apparatus for the perfect equipment of **isolated plants** for Hotels, Office Buildings, Flats and Factories.

STANDARD SYSTEMS

For distribution of lights and power in **large Manufacturing Establishments, Mills and Mines.**

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The most durable, economical and efficient on the market.

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BUFFALO, Erie County Bank Building.
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ST. LOUIS, American Central Building.
CHARLOTTE, N. C., 28-38 College St.
SYRACUSE, N. Y., Bastable Building.
SAN FRANCISCO, Mills Building.
WASHINGTON, D. C., 1333 F. St. N.
AHEARN & SOPER, OTTAWA, CANADA.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co. Chicago, Ill.

Lathes—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati
U. Baird Machinery Co., Pittsburg, Pa.
The Wright Co, Lowell, Mass.
Springfield Machine Tool Co., Springfield, O.

Machinists' Tools and Supplies—
Prentiss Tool & Supply Co., Chicago, Ill.
H. Bickford, Lakeport, N. H.
Davis & Egan Machine Tool Co., Cincinnati, O.
C. H. Besly & Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
The L. S. Starrett Co., Athol, Mass.
Skinner Chuck Co., New Britain, Conn.
Bertsch & Co., Cambridge City, Ind.
Lodge & Shipley Machine Tool Co., Cincinnati
C. H. Haeseler & Co., Philadelphia, Pa.
Springfield Machine Tool Co., Springfield, O.

Machine Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Hamilton Fdy. & Machine Co., Hamilton, O.
Springfield Machine Tool Co., Springfield, O.
Atwood & M'Caffrey, Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Manufacturers' Advertising—
United States Mailing Co., Cleveland, O.

Metal Bearings—
North American Metaline Co., Long Island City, N. Y.

Metallic Lath—
The Cincinnati Corrugating Co., Piqua, O.

Metal Saws—
Q. & C. Co., Chicago, Ill.

Milling Machines—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.

Mining Machinery—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Link-Belt Machinery Co., Chicago, Ill.
Earle C. Bacon, New York City.

Motors—
Westinghouse Electric & Mfg. Co., Pittsburg.
Franklin Electric Co., Miamisburg, O.

Molding Sand—
Ohio Sand Co., Conneaut, O.

Nickel—
Canadian CopperCo., Cleveland, O.

Oilless Bearings—
North American Metaline Co., Long Island, City, N. Y.

Oil Burners—
W. S. Rockwell & Co., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.

Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York City.

Pattern Leather Fillet—
Canton Leather Fillet Co., Canton, O.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

Pipe Covering—
C. H. Besly & Co., Chicago, Ill.

Planers—
Prentiss Tool & Supply Co., Chicago, Ill.
Davis & Egan Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.
U. Baird Machinery Co., Pittsburg, Pa.

Plates—
Pittsburg Steel & Iron Mfg. Co., Pittsburg, Pa.

Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.

Portable Drills—
C. H. Haeseler & Co., Philadelphia, Pa.

Power Presses—
Springfield Machine Tool Co., Springfield, O.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
Cady Mfg. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.

Presses—
Springfield Machine Tool Co., Springfield, O.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
Link-Belt Machinery Co, Chicago, Ill.

Pulley Blocks—
Moore Mfg. & Foundry Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.

Pumps (Steam)—
W. G. & G. Greenfield, East Newark, N. J.
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Willis Shaw, 416 N. Y. Life Bldg., Chicago.
Atwood & M'Caffrey, Pittsburg, Pa.

Pump Regulators—
Valley Iron Works, Williamsport, Pa.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Retort Coke Ovens—
Semet-Solvay Co., Syracuse, N. Y.

Rock Breakers—
American Hoist & Derrick Co., St. Paul, Minn.

Rock Drills—
Rand Drill Co., Chicago, Ill.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

Rolling Mill Supplies—
Atwood & M'Caffrey, Pittsburg, Pa

Rolls—
Samuel Tretheway & Co., Pittsburg, Pa.

Roofs—
Berlin Iron Bridge Co., East Berlin, Conn.
The Cincinnati Corrugating Co., Piqua, O.

Roofing Plates—
Morton Tin Plate Co., Cambridge, O.
The Cincinnati Corrugating Co., Piqua, O.

Rust Preventatives—
Otto Goetze, New York City.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.

Sand Blast Machines—
Ward & Nash, Chicago, Ill.

Saws—
Peter Gerlach & Co., Cleveland.

Schools—
International Correspondence Schools, Scranton, Pa.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.

Semi-Steel—
McDowell Steel Co., Chicago, Ill.

Shapers—
Springfield Machine Tool Co., Springfield, O.

Shafting—
Finished Steel Co., Youngstown, O.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Berger Bros., Philadelphia, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

Smoke Consumers—
American Smokeless Furnace Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.

Skylights—
Translucent Fabric Co., Quincy, Mass.

Stacks—
Wm. B Scaife & Sons, Pittsburg, Pa.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Vulcan Iron Works Co., Toledo, O.
Vulcan Iron Works, Chicago, Ill.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New York, N. Y.
The Johnson Co., Johnstown, Pa.
Potter & Hollis Foundry Co., Chicago, Ill.
McDowell Steel Co., Chicago, Ill.

Steel Knives—
Samuel Tretheway & Co., Pittsburg, Pa.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Cambria Iron Co., Johnstown, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O.

Steel Tanks—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Berlin Iron Bridge Co., East Berlin, Conn.

Stokers—
Playford Stoker Co., Cleveland, O.

Structural Engineers—
Berlin Iron Bridge Co., East Berlin, Conn.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.
Central Iron & Steel Co., Brazil, Ind.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

Tapping Machines—
Harvey Hubbell, Bridgeport, Conn.

Telephones—
Universal Telephone Co., Indianapolis, Ind.

Time Detector—
Nanz & Co., New York.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Morton Tin Plate Co., Cambridge, O.
Atlanta Steel & Tin Plate Co., Atlanta, Ind.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.

Torches—
Dangler Stove & Mfg. Co., Cleveland, O.

Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

Tube Welding—
S. Fix Sons, Cleveland.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Ventilating Fans—
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

Watchman's Time Detector—
Nanz & Co., New York.

Welding Compound—
Cornelius S. Mitchill, New York City.
E. G. Newhall & Co., Detroit, Mich.

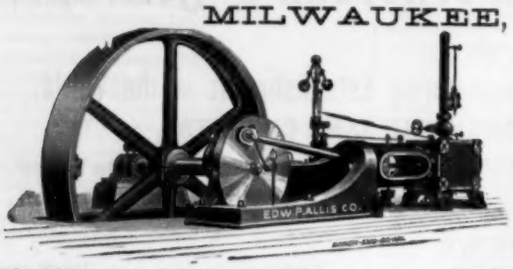
Wire Nails—
Salem Wire Nail Co., Salem, O.

Wire Rope—
American Hoist & Derrick Co., St.
Roberts Steel Chain Belting Co., Pittsburg.

Wire Machinery—
Cady Mfg. Co., Cleveland, O.
John Adt & Son, New Haven Conn.

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

Reynolds Patent Vertical Boilers.

Reynolds Corliss Engines.

NEW YORK, Room 1111 Havemeyer Bldg.
CHICAGO, Room 509, Home Ins. Bldg
MINNEAPOLIS, Room 416, Corn Exchange.
DENVER, 1316 18th Street.
SAN FRANCISCO, 31 Main Street.
PITTSBURG, 702 German National Bank Bldg.
SALT LAKE CITY, Desert Bank Bldg.
KANSAS CITY, Armour Bldg.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Acme Mineral Nugget Co.	18
Adt & Son, John	27
†Addyston Pipe & Steel Co.	—
Ætna-Standard Iron & Steel Co.	32
Aitchison, Rob't Perforated Metal Co.	31
Allis & Co., Edward P.	30
American Blower Co.	18
American Fire Brick & Clay Co.	17
American Hoist & Derrick Co.	35
American Smokeless Furnace Co.	17
Armstrong Bros. Tool Co.	1
Atlanta Steel & Tin Plate Co.	2
Atwood & M'Caffrey	26
Bacon, Earle C.	19
Baird Machinery Co.	18
Battle Creek Steam Pump Co.	20
Berlin Iron Bridge Co.	23
Besly & Co., C. H.	36
Bethlehem Iron Co.	35
*Berger Mfg. Co.	—
*Bertsch & Co.	—
Bickford, H.	36
Bourne-Fuller Co.	22
Brightman Furnace Co.	19
Brown, Edward	35
Brown Hoisting & Conveying Machine Co.	22
Bucyrus Steam Shovel & Dredge Co.	26
Buffalo Forge Co.	1
Cady Mfg. Co.	31
Cambria Iron Co.	33
Canadian Copper Co.	1
Canton Leather Fillet Co.	24
Central Iron & Steel Co.	35
Chicago Heights Land Ass'n.	25
†Chicago & Northwestern Ry.	—
Channon & Co., H.	36
Church, Isaac	35
Cincinnati Corrugating Co.	2
Claflen Mfg. Co.	20
Clearfield Fire Brick Co.	35
Cleveland & Buffalo Transit Co.	22
Cleveland City Forge & Iron Co.	1
Cleveland Electrotype Co.	23
*Cleveland Galvanizing Works	—
Cleveland Rolling Mill Co.	35
*Clonbrook Steam Boiler Co.	—
Coffman Coke Co., W. H.	32
*C. M. & St. P. Ry.	—
Cole, J. Wendell	36
Collins & Co., H. E.	1
Craig Ridgway & Son	21
Dangler Stove & Mfg. Co.	24
*Davis & Egan Machine Co.	—
Deming Co.	20
Detroit & Cleveland Steam Navigation Co.	23
*Diamond Machine Co.	27
Dickman & MacKenzie	2
Dixon, Jos. Crucible Co.	31
Dover Fire Brick Co.	35
Emmerton, F. A.	2
Empire Boiler Cleaning Co.	26
Enterprise Boiler Co.	36
Franklin Electric Co.	23
Finished Steel Co.	19
*Fix Sons	—
Fleharty, J. H. & Co.	27
Forster, Waterbury & Co.	1
*Freeman & Sons, S.	—
*Fulton Steam Boiler Wks. & Fdy. Co.	—
Garden City Foundry Co.	32
†Garden City Sand Co.	—
Gerlach, Peter & Co.	22
Gobeille Pattern Co.	24
Goetze, Otto	2-17
*Greenfield, W. G. & G.	—
*Haeseler & Co.	—
Hamilton Foundry & Machine Co.	1
Harrington & King Perforating Co.	34
Harrison Safety Boiler Works	16
Hartford Steam Boiler Insp. & Ins. Co.	20
Hazelton Boiler Co.	22
Hooven, Owens & Rentschler Co.	28
Hubbell, Harvey	36
Hunt & Co., Robert W.	2
Illinois Central R. R.	34
Illinois Screw Co.	1
Indiana Bicycle Co.	33
International Correspondence School	18
Iron Clad Paint Co.	31
Jeffrey Mfg. Co.	27
Jenkins Bros.	32
Jessop & Sons, Ltd., Wm.	27
Jones Foundry Co., W. A.	1
Johnson Co., The	32
Junction Iron & Steel Co.	2
Kellogg Weldless Tube Co.	21
Kurtz & Buhrer Foundry Co.	1
†Kelley & Co.	—
Lambert Gas & Gasoline Engine Co.	36
Link Belt Machinery Co.	20
Lloyd Booth Co.	34
*Lodge & Shipley Machine Tool Co.	—
Marine Iron Works	19
Marion Steam Shovel Co.	35
McDowell Steel Co.	35
McEwen Mfg. Co.	20
McNaull & Co.	20
Miller Gas Engine Co.	18
Mitchill, Cornelius S.	22
Monarch Cycle Mfg. Co.	24
Morton Tin Plate Co.	22
Moyes, L. M.	27
Moore Mfg. & Foundry Co.	1
*Nanz & Co.	27
National Engraving Co.	24
Newell Bros.	1
Newhall & Co.	17
Norman Co., J. J.	24
North American Metaline Co.	36
Oglebay, Norton & Co.	22
Ohio Sand Co.	36
Otto Gas Engine Co.	31
Pittman, C. K.	2
Pittsburg Steel & Iron Mfg. Co.	24
Pollock, Wm. B. & Co.	2
Playford Stoker Co.	25
Pope, E. C.	22
Potter & Hollis Foundry Co.	18
Prentiss Tool & Supply Co.	27
Q. & C. Co.	36
Rand Drill Co.	2
Reese, Hammond & Co.	36
Roberts Steel Chain Belting Co.	32
Rockwell & Co., W. S.	23
Salem Wire Nail Co.	34
Scaife & Sons, Wm. B.	1
Semet-Solvay Co.	22
‖Sharon Fire Brick Works.	1
Sharpless & Winchell.	36
†Shaw Electric Crane Co.	—
Shiffler Bridge Co.	33
Skinner Chuck Co.	36
Southwark Foundry & Machine Co.	22
Springfield Machine Tool Co.	36
Standard Paint Co.	35
Star Dynamo Co.	31
Starrett Co.	1
Sterling Emery Wheel Mfg. Co.	34
Stirling Co.	20
Stevens, F. B.	36
Stilwell-Bierce & Smith-Vaile Co.	2
Stowe, Fuller & Co.	17
Stuart Fire Brick Co.	33
Sturtevant Co., B. F.	2
Sykes Iron Roofing Co.	23
Taylor & Boggis Foundry Co.	1
Textor, O.	2
Thurman Fuel Oil Burner Co.	19
Tod, Wm. & Co.	34
Toledo Machine & Tool Co.	35
Totten & Hogg I. & S. F'dry Co.	20
Trethewey & Co.	24
Translucent Fabric Co.	25
Union Mining Co.	17
United States Mailing Co.	36
Universal Telephone Co.	1
Upson Nut Co.	1-19
Valley Iron Works	24
*Vulcan Iron Works, Toledo	—
Vulcan Iron Works, Chicago	23
Wickes Bros.	2
†Ward & Nash	—
Westinghouse Electric & Mfg. Co.	29
Westmoreland Fire Brick Co.	31
Wright Co.	27
Young, J. D.	19

If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@4.75
No. 1 Bessemer hematite	4.00@4.25
Hematites No. 1 non-Bessemer	2.25@2.75
No 1. Specular, non-Bessemer	2.75@3.25

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$13 75@14 00
No. 1 Strong Foundry	12 75@13 00
No. 2 Strong Foundry	12 00@12 50
No. 1 Gray Forge, red short	11 75@12 00
No. 2 Gray Forge, neutral	11 25@11 50
No. 1 American Scotch	13 00@13 25
No. 2 American Scotch	12 50@12 75
Lake Superior Charcoal	13 50

PITTSBURG:

No. 1 Foundry	$12 75@13 25
No. 2 Foundry	12 00@12 25
Gray Forge	11 25@11 50
White and Mottled	10 75@11 00
Warm Blast Charcoal	15 00@16 00
Cold Blast Charcoal	22 00
Bessemer	13 75

CHICAGO (reported by our representative):

Lake Superior Charcoal	$13 50@14 00
Local Coke Foundry No. 1	12 50@13 00
Local Coke Foundry No. 2	12 00@12 50
Local Coke Foundry No. 3	11 00@12 00
Local Scotch Foundry No. 1	12 50@13 00
Local Scotch Foundry No. 2	12 00@12 50
Local Scotch Foundry No. 3	11 25@12 00
Southern Coke No. 1	12 10@12 35
Southern Coke No. 2	11 60@11 85
Southern Coke No. 3	11 10@11 60
Southern No. 1 Soft	11 60@11 85
Southern No. 2 Soft	11 35@11 50
Southern Silveries No. 1	11 85@12 35
Southern Silveries No. 2	11 60@11 85
Jackson Co. Silveries	14 50@16 00
Ohio Silveries No. 1	15 00@15 50
Ohio Silveries No. 2	14 50@15 00
Ohio Strong Softeners	15 00@15 50
Alabama Car Wheel	16 85@17 35
Malleable Bessemer	13 50@14 00
Coke Bessemer	13 00@14 00

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$10 75@11 25
Southern Coke No. 2 and No. 1 Soft	10 25@10 50
Hanging Rock Coke, No 1	12 50@13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@17 00
Tennessee Charcoal No 1	13 00@14 00
Jackson County Silvery No 1	14 00@14 50
Southern Coke, Gray Forge	9 25@9 50
" " Mottled	9 00@9 25
Standard Alabama Car Wheel	15 00@16 00
Tennessee " "	14 00@15 00
Lake Superior " "	14 50@15 00

BUFFALO:

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$13 00@13 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	12 50@12 75
Ohio Strong Softener No. 1	13 00@13 25
Jackson Co. Silvery No. 1	14 75@15 25
Lake Superior Charcoal	13 50@14 00
Southern Soft No. 1	11 57@12 00
Hanging Rock Charcoal	17 00

ST. LOUIS (reported by Rogers, Brown & Mencham):

Southern Coke No 1	$11 50
Southern Coke No. 2	11 00
Southern Coke No. 3	10 50
Southern Gray Forge	10 00
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@15 00
Ohio Softeners	16 00
Lake Superior Car Wheel	15 00
Southern Car Wheel	16 25

OLD RAILS AND SCRAP METAL.

	GROSS TONS
Old iron rails	$16 25
Old steel rails	12 25
Old car wheels	13 00
	NET TONS
No. 1 R. R. wrought scrap	$12 75
Mill scrap	10 00
No. 1 Machine cast scrap	10 00
Iron axles	17 50
Axle turnings	9 00
Wrought turnings (free from cast)	8 00
Cast borings	7 00
Uncut wrought iron boilers	4 00
Steel boiler plates	10 00
Grate bars	6 75
Pipes and flues (clean)	10 00
Tank iron	10 00
Hoop and band iron	7 00
Sheet iron	6 50
Wrought drillings	7 50
Malleable iron	10 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.54c
Angles	1.34c@1.39c
Tees	1.49c
Universal Plates	1.45c
Sheared Plates	1.50c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 30
4½ to 6 by ⅜ to 1 inch	1 35
1½ to 6 by 1⅛ to 2 inch	1 35
1¼ & 1⅜ by ⅜ to ¾ inch	1 10
1 & 1⅛ by ⅜ to ½ inch	1 20
⅝, ¾, ⅞, by ⅜ to ½ inch	1 30

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.

THE CADY MFG. CO.

18, 20 and 22 Johnson St., CLEVELAND, O.

SEND FOR OUR NEW CATALOGUE OF Power Presses, Drop Hammers, Punches and Shears, Wire Working and Special Machinery.

PERFORATED METALS

OF ALL KINDS FOR

MILLING MINING AND AGRICULTURAL MACHINERY,

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.

LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

THE ROBERT AITCHISON. PERFORATED METAL CO.,

OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS

WESTMORELAND FIRE BRICK CO.

MANUFACTURERS OF HIGH GRADE **FIRE BRICKS.**

PITTSBURG, PA.

Works and Mines, Westmoreland, Pa.

PL

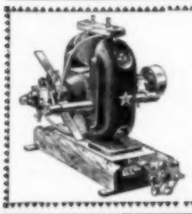
DIXON'S PERFECT LUBRICATING GRAPHITE.

The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease

NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.

An Interesting and Instructive Pamphlet will be sent Free of Charge.

JOS. DIXON CRUCIBLE CO. Jersey City, N. J.



SMALL DYNAMOS

For Incandescent Lighting,

In Factories, Mills, etc., at a Reasonable Price.

If you have power put in your own lighting plant. Write for our Catalogue.

STAR DYNAMO CO., Jefferson City, Mo.

POWER From **GAS OR GASOLINE.**

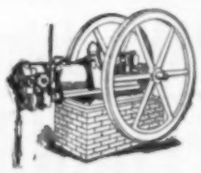
No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 250 horse-power. } **Can be Used in City or Country.**

THE OTTO GAS ENGINE WORKS, Inc.

33d and Walnut Sts., PHILADELPHIA, PA.

S. M. York, 42 S. Water St., Cleveland Agent. Over 45,000 Sold.



IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE **Iron Clad Paint Co.**

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅜ inch	1 10
1 to 2⅜ inch	1 30
2⅜ to 3¼ inch	1 25
3⅜ to 4 inch	1 60
4¼ to 4⅜ inch	2 20
4¾ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 30
⅜ to ¾ inch	1 30
½	1 50
⅝	1 70

Half Oval and Half Round.

1¼ to 3 inch	1 65
⅜ to 1⅛ inch	1 45
⅜ to ¾ inch	1 70
½	1 85
⅝	2 90

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 20
1 to 1¾ by ¼ and 5-16 inch	1 25
¼ to ⅜ by ¼ and 5-16 inch	1 35
½ to ⅝ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 35
1 7-16 to 2, No. 17, 18 and 19	1 40
1 7-16 to 2, No. 20	1 50
1 7-16 to 2, No. 21	1 60
1 7-16 to 2, No. 22	1 70
1⅛ to 1¾, No. 13, 14 and 15	1 40
1⅛ to 1¾, No. 16, 17 and 18	1 45
1⅛ to 1¾, No 19 and 20	1 50
1⅛ to 1¾, No. 21	1 60
1⅛ to 1¾, No. 22	1 70
15-16 and 1 inch, No. 13, 14 and 15	1 35
15-16 and 1 inch, No. 16, 17 and 18	1 50
15-16 and 1 inch, No. 19 and 20	1 60
15-16 and 1 inch, No. 21	1 70
15-16 and 1 inch, No. 22	1 80
⅞, No. 13, 14 and 15	1 60
⅞, No. 16, 17 and 18	1 70
⅞, No. 19 and 20	1 80
⅞, No. 21	1 90
⅞, No. 22	2 00
13-16, No. 13, 14 and 15	1 70
13-16, No. 16, 17 and 18	1 80
13-16, No. 19 and 20	1 90
13-16, No. 21	2 00
13-16, No. 22	2 10
¾, No. 13, 14 and 15	1 80
¾, No. 16, 17 and 18	1 95
¾, No. 19 and 20	2 05
¾, No. 21	2 15
¾, No. 22	2 25
11-16, No. 13, 14 and 15	2 05
11-16, No. 16, 17 and 18	2 10
11-16, No. 19 and 20	2 20
11-16, No. 21	2 30
11-16, No. 22	2 40
11-16, No. 23	2 50
⅝, No. 13, and 15	2 10
⅝, No. 16, 17 and 18	2 20
⅝, No. 19 and 20	2 30
⅝, No. 21	2 40
⅝, No. 22	2 50
⅝, No. 23	2 60
9-16, No. 13, 14 and 15	2 30
9-16, No. 16, 17 and 18	2 40
9-16, No. and 20	3 50
9-16, No. and	1 60
9-16, No. 221	2 70
9-16, No. 22	1 80
7-16 ad ½ inch, No. 13, 14 and 15	3 50
7-16 and ½ inch, No. 16, 17 and 18	2 60
7-16 and ½ inch, No. 19 and 20	2 70
7-16 and ½ inch, No. 21	2 80
7-16 and ½ inch, No. 22	2 90
7-16 and ½ inch, No. 23	3 00
½, No. 13, 14 and 15	3 00
½, No. 16, 17 and 18	3 10
½, No. 19 and 20	3 20
½, No. 21	4 50
½, No. 22	3 60
½, No. 23	3 75

Light Band.

1⅜ to 6 by ⅛ to 3-16 inch	1 60
1⅜ to 6 by Nos. 11 and 12	1 65
1 to 1⅜ by ⅛ to 3-16 inch	1 65
1 to 1⅜ by Nos. 11 and 12	1 70
⅜ and 13-16 by ⅛ to 3-16 inch	1 80
⅜ and 13-16 by Nos. 11 and 12	1 75
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	1 50
⅜ inch, " " " " 13 and 14	1 60
½ inch, " " " " 11 and 12	1 63
½ inch, " " " " 13 and 14	1 75

Sheet Iron.

No. 10	1 45
No. 12	1 55
No. 14	1 65
No. 15-17	1 75
No. 18	1 90
No. 20	2 15
No. 22-24	2 15
No. 25-26	2 25
No 27	2 35

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 60
Flange	1 70
Marine Flange	2 00
Fire Box	2 50

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ₱ lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ₱ lbs
1 to 2 in. inclusive	08
9-16 to ⅞ in. "	06

ÆTNA-STANDARD IRON AND STEEL COMPANY,

BRIDGEPORT, OHIO,

MANUFACTURERS OF

TIN AND TERNE PLATE, Iron and Steel Plates and Sheets, Plain Black, Painted, Corrugated and other forms of ROOFING, SIDING and CEILING. Patent Leveled Galvanized Sheets, BARS, Light Section Rails, ANGLES, Tees, Channels, and other Miscellaneous Bars and SHAPES.

WITH SUCH DIVERSITY OF PRODUCT,

SPECIAL ADVANTAGES are offered buyers of mixed lots, effecting saving in freight charges and by reason of our LARGE STOCKS, securing **PROMPT SHIPMENT.**

INQUIRIES INVITED AND CATALOGUES MAILED ON APPLICATION.

ROBERTS STEEL CHAIN BELTING CO., Pittsburg, Pa.

Elevating and Conveying Machinery

For Handling all kinds of materials.

Special Wrought and Steel Chains of every description; Coil and Cable Chains: Chain Haulages for Coal Mines; Sprocket Wheels; Complete Coal and Ashes Handling Plants; Wire Rope Haulages and Wire Rope.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other coke

STEEL CASTINGS

FROM 10 LBS. UPWARD.

Made from Best Open-Hearth Steel.

ALSO SAND ROLLS AND CAST-IRON PINIONS.

SEND FOR ESTIMATES.

THE JOHNSON COMPANY, Johnstown, Pa.

GARDEN CITY FOUNDRY CO.

INCORPORATED.

Successors to TURNER, DICKINSON & CO.

Armitage and Central Avenues, Station G, Chicago, Ill.

FRICTION CLUTCHES, HANGERS, PILLOW BLOCKS & PULLEYS.

Large Stocks on Hand. Shipments Promptly Made.

. . '96 JENKINS '96 . .

Is the Perfection of Joint Packing. Instantaneous. Does not Squeeze Out and not Necessary to follow up Joint. We guarantee it to last for years on any and all pressures of steam or any kind of joint where packing is required. Does not Rot, Burn or Blow Out, therefore the best for all purposes. Call for and insist on having '96 JENKINS '96 stamped like cut.

Jenkins Bros., New York, Boston, Philadelphia, Chicago.

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅛ to 4 in.	.09½
⅝ to 11-16 and 4⅛	.10
⅛ to 6 in.	.10½
¼ to 9-32 and 6⅛ to 7 in.	.11
7 in	.13

Flats.

	cts. ₩ lbs
2 to 9-16 in. wide by 2 to ⅝ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 80
Open-hearth Spring	"	2 20
Sleigh Shoe	"	1 90
Toe Calk	"	2 10
Cutter Shoes, tapered and bent	"	2 20

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis.
Lap " galv. "	dis. 5½
Butt " " "	dis. 50
Boiler tubes 2¾" and smaller	dis 6, ½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

Main Office and Works:
48th Street and A. V. Ry.
PITTSBURG, PA.

Branch Offices:
1123 Betz Building, Philadelphia, Pa.
65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

CAMBRIA STEEL.

Steel Rails, Blooms, Billets, Bars, Axles, Angles, Channels, Forgings, Locomotive Car and Structural Steel.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co. Works at Johnstown, Pa.

GAUTIER STEEL DEPARTMENT OF CAMBRIA IRON CO.,

JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.
AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.
PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Per. ot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

New York Office, 102 Chambers St. | Philadelphia Office, 611 Phila. Bourse. | Chicago Office, 209 Western Union Bldg. | At anta Office, 325 Decatur st

STUART FIRE BRICK CO.

MANUFACTURERS OF
Silica Brick
For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.
Office, Room 21, Conestoga Bldg., Cor. Wood and Water Sts., PITTSBURG, PA.

The Iron Trade Review Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

A POINTER TO DEALERS.

You have seen the words at the top of this ad. so often that they are engraved upon your mind. They are likewise engraved upon the mind of almost every individual who can read. When a person thinks of bicycles the first thing that flashes upon the mind is Waverley and that is the first wheel asked for. Do you realize the importance of being able to supply what a prospective buyer wants? Just consider it for a few moments, and then write us for terms.

INDIANA BICYCLE CO., **INDIANAPOLIS, IND.** EASTERN DISTRIBUTING BRANCH, **339 BROADWAY, NEW YORK.**

Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F. F. FF.
Kegs, ℔ lb	4½c	5 c	2½c
½ kegs ℔ lb	4¾c	5¼c	2¾c
¼ kegs ℔ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 50@50&5
H. H. Barton ..... dis 50@50&5

Emery Wheels.

Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 50
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@75
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F. ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 60@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 50
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs 12c
" " " " over 5 lbs 10c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15½	11½	8½	6	5½	5¼	
Washers	9	8	7	5	4⅛	4½	4⅛

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887 ..... dis 85
Standard Penny Nails, ℔ keg card rate
Car lots $2.25
Less than car lots $2.35

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz ..... dis 10@10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Pulleys.

Iron Pulleys, Walker List ..... dis 50
Medart Pulleys ..... dis 50
Split Wood Pulleys ..... dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block ..... dis 20

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in ..... dis 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 4c
Copper ..... dis 4c
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75& 5
" " Nos. 27@36 ..... dis 75&10& 5
Coppered Nos. 0 to 18, market list ..... dis 70@70& 5
Galvanized Nos. 0 to 18 " " ..... dis65& 5
Tinned market Nos. 0 to 18 ..... dis 67½
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&5@70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... 95c ℔ lb dis 30

Wrenches.

Coe's genuine ..... dis 50
Girard Standard ..... dis 70&10
Agricultural ..... dis 75&10
Mechanic's ..... dis 55&10& 5
Bemis & Call's Combination ..... dis 35
Donohue's Engineers ..... dis 20&10
Lamson & Sessions Engineers ..... dis 65
Billings & Spencer's Drop Forged ..... dis 25
William's " " ..... dis 25
Alligator " " ..... dis 40

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

BRONZE SCREEN PLATES To withstand action of ACIDULATED WATERS.

PERFORATORS OF STEEL, IRON, COPPER, ZINC, BRASS AND TIN.

For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES. DISTILLERIES, FILTER PRESSES. STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

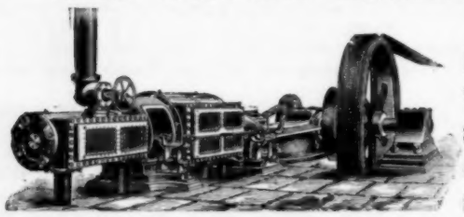
STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

Main Office and Works, 222 to 240 No. Union St., Chicago, Ill., U. S. A. Eastern Office, No. 284 Pearl St., New York.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Williams Improved Vertical Engines

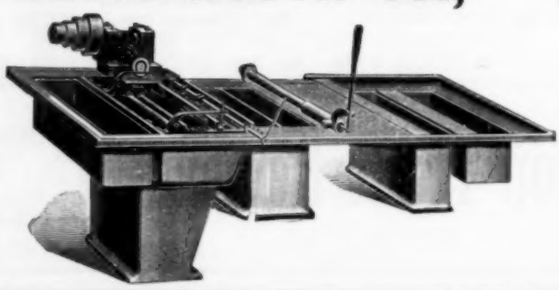
For Direct Electrical and all High Class Work.

39-41 Cortland St., N. Y. E. F. WILLIAMS.

1025 Monadnock B'ld'g, Chicago. ALBERT FISHER.

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY.



Rolling Mills, Sand and Chill ROLLS.

ARE YOU LOOKING

FOR A CHANGE IN LOCATION?

If you are not satisfied with your present site, or if you are not doing quite as well as you would like to, why not consider the advantages of a location on the Illinois Central R. R. or the Yazoo & Mississippi Valley R. R.? These roads run through South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Kentucky, Tennessee Mississippi and Lousiana, and possess

FINE SITES FOR NEW MILLS,

BEST OF FREIGHT FACILITIES,

CLOSE PROXIMITY TO

COAL FIELDS AND DISTRIBUTING CENTERS

AND

INTELLIGENT HELP OF ALL KINDS,

MANY KINDS OF RAW MATERIAL.

For full information, write the undersigned for a copy of the pamphlet entitled

100 Cities and Towns WANTING INDUSTRIES

This will give you the population, city and county debt, death rate, assessed valuation of property, tax rate, annual shipments, raw materials, industries desired, etc.

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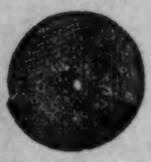

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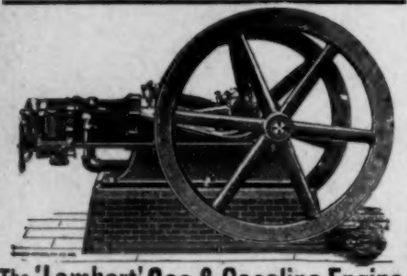

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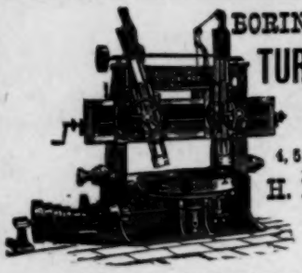

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